CHEMICAL
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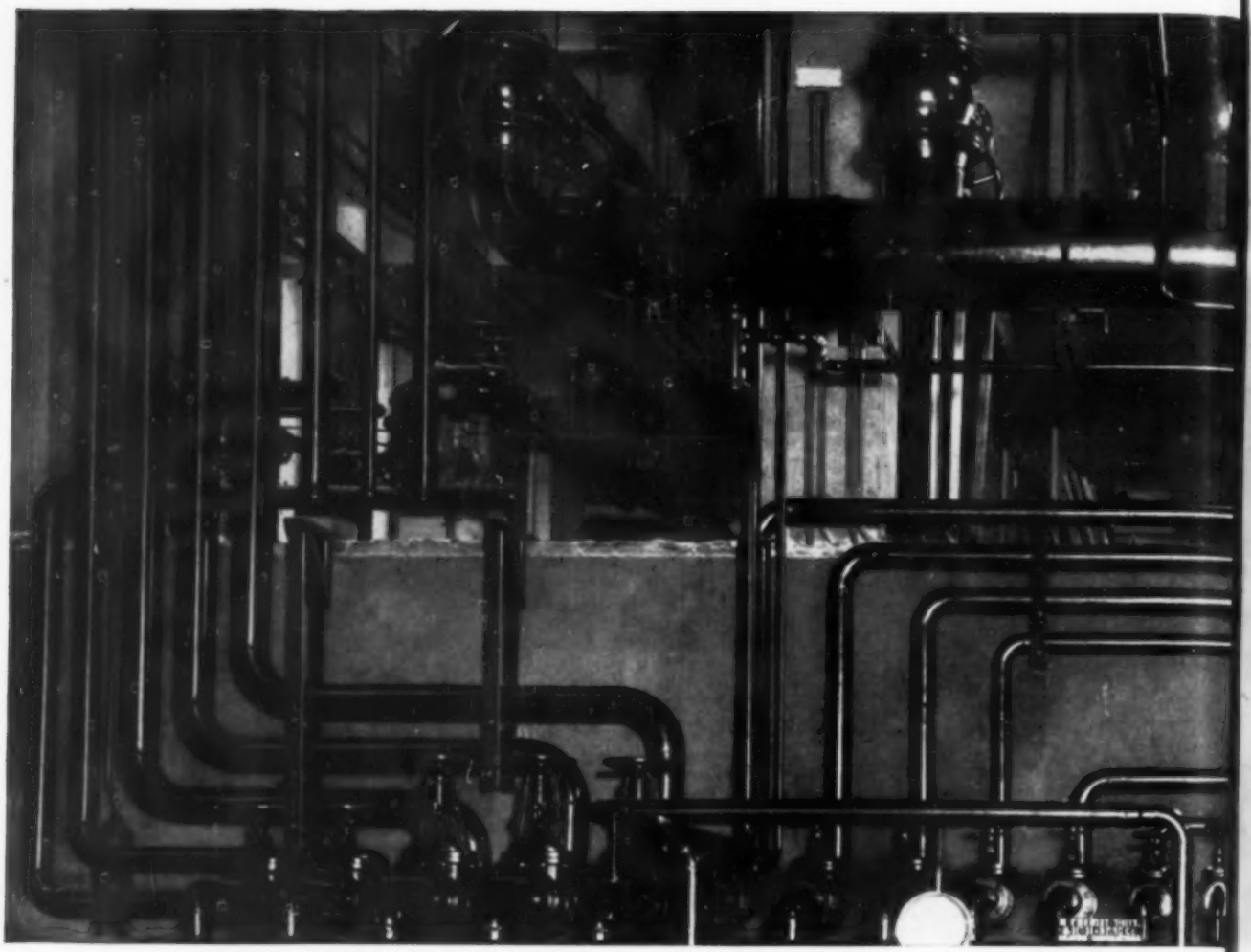
ENGINEERING

For JUNE, 1945 • GERMANY IN A JEEP • COLLOIDS FROM KELP GIVE RISE TO UNIQUE INDUSTRY • SUBZERO SERVICE REQUIRES SPECIAL METALS • CHEMICALS FOR SYNTHETIC RESINS • CAPACITY CONTROL FOR ATMOSPHERIC COOLING TOWERS • RECOVERING GRAIN ALCOHOL BYPRODUCTS • CHEM & MET REPORT ON PETROLEUM PROCESSES AND CHEMICALS

U. S. Air Force pays its respects to the German I. G. works at Ludwigshafen



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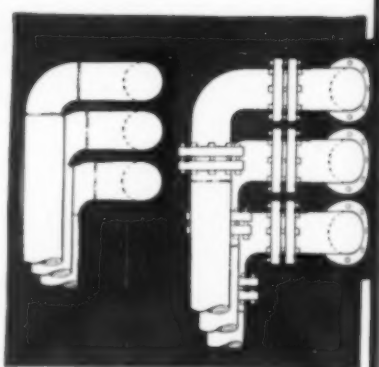

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CHEMICAL & METALLURGICAL ENGINEERING

JUNE • 1945

Volume 52 Number 6

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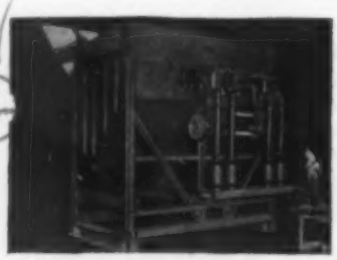

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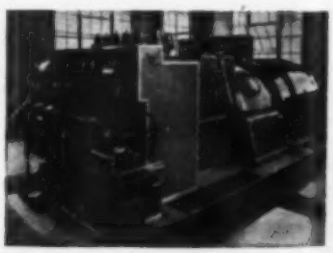

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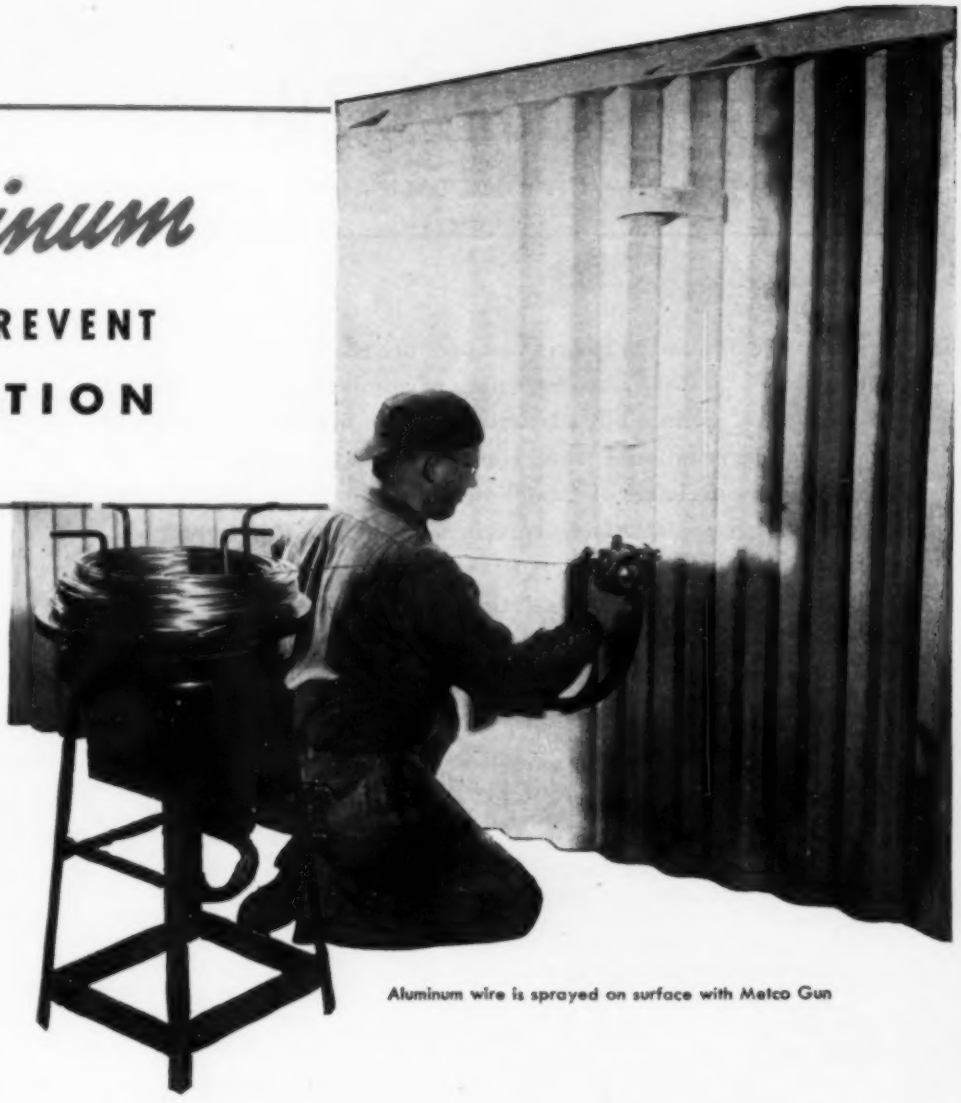

Aluminum wire is sprayed on surface with Metco Gun

Thirty pounds of Alcoa aluminum wire, fed through a special gun and sprayed on ordinary carbon steel, protected these annealing boxes against high temperature oxidation. This cut costs from one-third to one-half by replacing special alloy steel which called for 240 pounds of nickel and 600 pounds of chromium vitally needed in war production.

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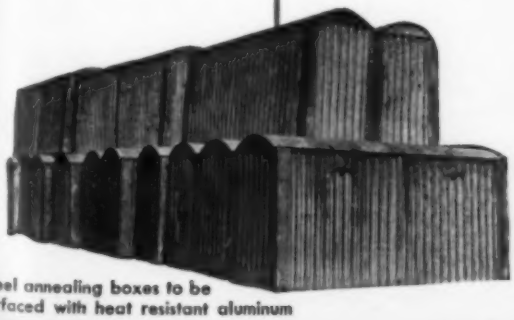


Steel annealing boxes to be surfaced with heat resistant aluminum

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

WATCHING WASHINGTON

R. S. McBRIDE, Editorial Consultant • PAUL WOOTON, Chief of McGraw-Hill Washington Bureau • J. V. HIGHTOWER, Washington Correspondent

Semi-commercial plant at Peoria will produce motor fuel from waste farm products . . . Navy abandons plan to eliminate patent infringement suits . . . Senate bill advocates registration with Department of Justice of international trade contracts and agreements . . . Cut in government purchases of Canadian aluminum . . . Manufacturing Chemists' Association is drafting a national safety code . . . Surplus Property Board studies plans and policies for disposal of aluminum plants and two western steel mills . . . Stockpile of natural rubber reported to be in danger zone . . . Plenty of grain promised for industrial processing . . . More nitrogen expected for agriculture

MOTOR FUELS FROM COBS

A SEMI-COMMERCIAL plant utilizing a new process for the conversion of agricultural residues into motor fuel and other products will be in experimental operation in about five months, says the Department of Agriculture. The plant will be installed at the department's Northern Regional Research Laboratory at Peoria, Ill.

A continuous process for saccharification of corncobs and cottonseed hulls was developed at the Peoria laboratory. Experimental data indicate a ton of such products will yield 90 to 95 gal. of liquid motor fuel, about one-half of which is ethyl alcohol. Other agricultural residues to be tested include bagasse, peanut shells, oat hulls and flax shives. It is estimated that about 100,000,000 tons per year of such wastes might be available for processing.

The new plant is designed to process 6,600 lb. of raw residues per 8-hr. operating period and produce therefrom 2,000 lb. of dextrose, 1,600 lb. of xylose, 1,000 lb. of lignin and 200 lb. of furfural. The important item of economic feasibility is still in the air. Cost figures are not yet available.

The Peoria project is part of a program authorized in 1944 by Congress for large-scale studies of production of synthetic liquid fuels from oil shale, coal and farm and forest products. Bulk of the program belongs to the Bureau of Mines.

LONG-TERM GUAYULE

ON MAY 14 the House passed and sent to the Senate the Poage bill establishing a government supported minimum price of 28c. per lb. at the mill for processed crude guayule rubber harvested before June 30, 1956. The measure, intended to encourage further guayule production, limits its benefits for any one grower in a given year to an area not over 100 acres. The Secretary of Agriculture is authorized to continue a comprehensive guayule research and development program.

This is a home industry measure with a national security angle. Washington looks for East Indies rubber to return not later than two or three years. However, there is some question as to what extent the Pacific plantations and their facilities have been or may yet be damaged.

HOW SCARCE PLASTICS?

VARIOUS degrees of scarcity of plastics and plastic raw materials are recognized by WPB. That agency warns about some commodities which are "expected to remain in very short supply." It also gives some comforting news about the more abundant commodities. At the end of May the Chemicals Bureau of WPB described three groups, classified according to scarcity expected, as follows:

Group I—Expected to remain in very short supply throughout 1945: Synthetic resins (phthalic alkyd resins, para phenyl, butyl, amyl and meta para cresol phenolic resins, maleic resins, urea and melamine resins, and nonrosin containing synthetic resins); chemical plasticizers (dibutyl phthalate and tricresyl phosphate); solvents (toluene, methyl ethyl ketone, and Class B aromatic solvents); chrome pigments; rosin; naphthenate driers.

Group II—Expected to remain in short supply, yet sufficient to provide for important essential civilian approved programs: Solvents (butyl alcohol, butyl acetate, isopropyl acetate, xylol, and Class A aromatic solvents); drying oils; lead pigments; congo gum, pentaerythritol esters.

Group III—Expected to cause little or no real difficulties for essential civilian purposes: White pigments (titanium dioxide and lithophone); rosin modified phenolic resins; ethyl acetate, acetone, methyl isobutyl ketone; nitrocellulose; inert pigments.

RECONVERSION INDEX

NO SINGLE index can be used to measure the rate of reconversion of chemical process industries to a peace basis. But there is one index that no chemical engineer executive dare neglect. It is the rate at which WPB is releasing restricted materials and equipment for modernization, expansion, or new plant building.

There is a huge backlog of applications in the Chemicals Bureau of WPB in the file of still unapproved requests for plants and plant facilities. The time has now arrived when this log jam of applications will begin to break away. In any event, it will be a sure sign of postwar progress as approvals begin to come through in substantial numbers. On or before that date the wise chemical engineer will have filed with the appropriate division of the Chemicals Bureau his requests for approvals.

PETROLEUM DATA RELEASED

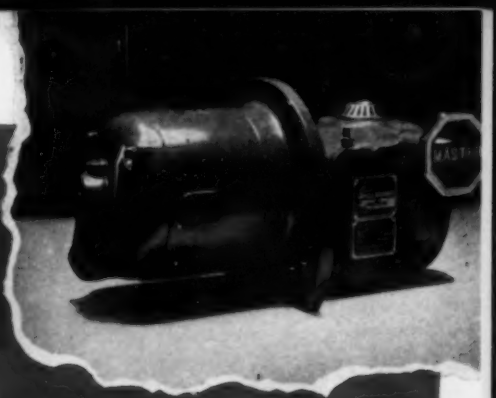
WAR demands for petroleum products have been stated officially by Petroleum Administration for War as follows: Production of 100-octane aviation gasoline by the United Nations averages over 21 million gallons daily. Military demands for all types of gasoline averaged more than 33.6 million gallons daily last year, which accounts for the cut of civilian passenger car supplies to 36 percent of the use in 1941.

World-wide needs of United Nations for petroleum and its products exceed 7 million barrels of crude per day, which comes from the United States 69 percent; South America 14 percent; the Middle East 7 percent; Russia 9 percent.

PATENT PLAN FLOPS

THE NAVY Department plan to eliminate patent infringement suits has been abandoned and companies which had agreed to waive claims for infringement during military use of their private patents are released to take appropriate action individually as they may wish. The Navy Department officially announced this to all firms which are Navy contractors.

The original plan, it was hoped, would have eliminated suits against the govern-



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ment for patent infringement during the manufacture of goods for the war emergency. The Navy proposed to its 18,000 prime contractors that they agree not to make any claims for such infringement. But the Navy recognized that practically unanimous acceptance of such a plan was necessary lest some firms profited, while getting big patent royalties and others waived their rights without payment. Since the Navy was unable to get substantial unanimity, all contractors who had generously agreed to such waiver are now released from their tentative pledge. The Navy makes no guess as to the number of infringement claims that will have to be faced; but it is evident that they are very numerous and that the dollars involved may represent a staggering total.

CARTELS UNDER FIRE

STRONG Department of Justice support is behind Senator O'Mahoney's bill requiring registration with the department of international contracts and agreements relating to prices, apportionment of market areas, restrictions on amounts and types of commodities or processes and patent agreements. The bill was before the Senate Judiciary Subcommittee late in May.

The Justice Department has been blasting away at cartels during hearings and is anxious to put full glare of publicity on these arrangements. Senator O'Mahoney's bill requires that contracts and agreements be opened to the public, but provides that on petition from a party to a foreign contract, the attorney-general "shall withdraw from public disclosure all or part of such contract as may be necessary in order to prevent the disclosure of a trade secret."

Company officials testifying before the subcommittee express doubt as to how much protection would be afforded. They also fear the bill is an opening wedge for antitrust actions. Other critics of the measure see in its publicity clause possibility of undesirable disclosure of legitimate company activities affecting the national interest, therefore are somewhat skeptical.

PAW STUDIES RECONVERSION

A RECONVERSION subcommittee has been established by the Domestic Operating Committee of the Petroleum Administration for War to study reconversion problems confronting petroleum. PAW will consider the subcommittee's recommendations in dealing with WPB and other Washington agencies affecting the present course and immediate future of the industry.

Return to more nearly normal operations, say authorities, does not mean for oil the wholesale alterations in equipment and processes and the loss of time facing some other activities. However, oil has its problems. A large backlog of long-deferred repair and replacement work exists. There is pressure to replace obsolete equipment with more efficient facilities. Refiners want pilot plants for development of new processes conceived during the war. Companies are urging PAW to recommend, and WPB to authorize, new projects desired for postwar competition. Nevertheless, the official floodgates for new construction have not yet been thrown open. With a few exceptions, authorization for unavoidable and wartime construction is still the rule.

EXPORTERS BEWARE

THE SUPREME COURT has dashed the belief of export associations that such organizations operating under the Webb-Pomerene Act and the Federal Trade Commission administration thereof are protected from anti-trust actions until such time as the FTC has recommended such actions to the Department of Justice. Anti-trust suits were filed in Federal District Court for the Southern New York District against United States Alkali Export Association, California Export Association and 13 member chemical firms. The defendants carried the suits to the Supreme Court on writs of certiorari to review the order of the district court denying motion to dismiss.

Against contentions of the defendants the Supreme Court ruled on May 21 that the absence of action by FTC does not preclude independent action by the Department of Justice. The decision strengthens the department's authority and emphasizes that adherence to the Webb-Pomerene Act is no guaranty of immunity, even though the Federal Trade Commission has not complained of export association acts.

CANADIAN ALUMINUM

UNDER contractual provisions Metals Reserve Corp. has advised Aluminum Co. of America that the contract for purchase of 250,000,000 lb. of aluminum from the company's plants at Quebec during the second half of 1945 is to be reduced by 150,000,000 lb. The action was taken on recommendation of WPB on the grounds that military requirements for the metal have decreased. Speculation in some quarters attributes the move to the inquiry into the Shipshaw project by the Senate Small Business Committee. Chairman Murray of the committee says the action will result in increased production of aluminum in the Pacific Northwest.

SAFETY CODE PLANNED

MANUFACTURING Chemists' Association has organized a new committee to formulate plans for a national chemical safety code. The purpose is to draft up a comprehensive code to protect the lives of all persons engaged in the production, transportation, or use of chemical materials.

MCA has been working on safety questions regarding types of containers, container handling, and labeling of hazardous chemicals for a period of several years. All of those activities give the new code committee a running start on the job which they have undertaken.

Two of the manuals of MCA dealing with particular phases of safety have just been completed and initial distribution undertaken. Manual L-1 is entitled "A Guide For the Preparation of Warning Labels For Hazardous Chemicals." It for the first time classifies all sorts of hazards and gives precise definitions of terms. Thus it makes possible preparation of precise and informative labels for any new commodity as soon as the properties of that commodity are known. Manual L-2 is entitled "Product Caution Labels."

STEEL-ALUMINUM INQUIRY

INTENSIVE study of economic and technical considerations which will determine the sale of aluminum and steel plants has been started by Surplus Property Board. Dr. J. R. Mahoney a professor of economics from Harvard and Samuel Moment an engineer loaned by Bonneville Power Administration will be in immediate charge of this investigation of plans and policies for disposal of 50 aluminum plants which cost $700 million and the two western steel plants.

Decisions as to policy will not be made be these two investigators. Questions of that sort will be resolved by Hans Klagsbrunn who is now chief of the Surplus Property division of RFC. That is the newly established agency of the board which will handle all phases of disposal of industrial real estate, factories, mining properties, and facilities for such industrial use.

It is expected that comparable investigations will be made for each of the important types of industrial property, especially those other ten groups on which SPB must report its plans for disposal to Congress under the law which established that agency.

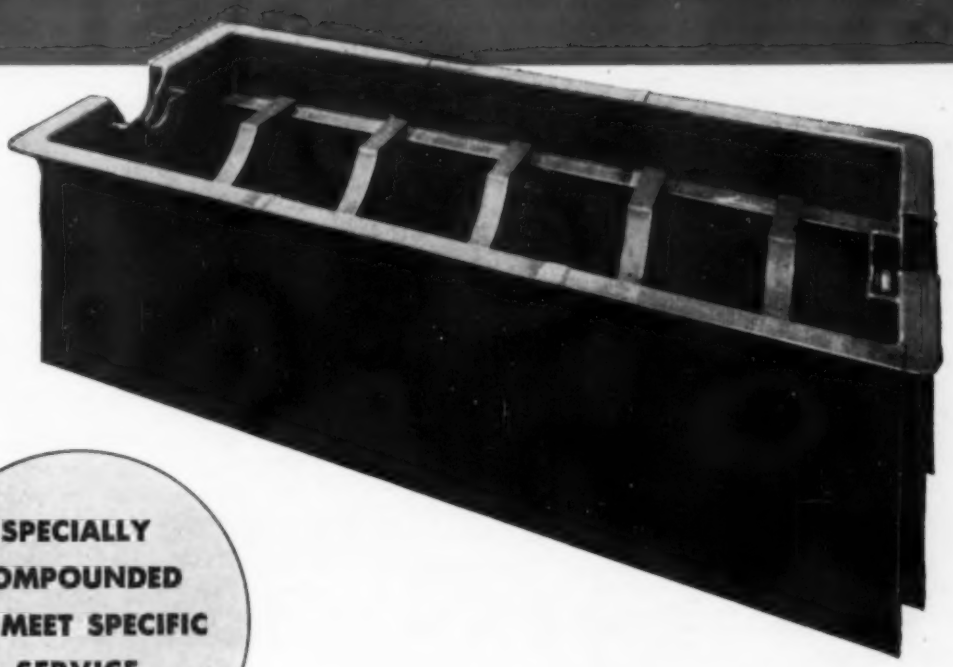
LESS POTASH FOR INDUSTRY

ABOUT 10 percent less potash will be allocated for industrial use for the balance of this year, it is announced by WPB. This cut back is made in order that agricultural needs for potash may be more nearly met.

The chance of import of potash from Europe and the Near East is not great for the early future. Mining facilities in France, Germany, and Poland are believed either destroyed or so seriously restricted in output that they will not be able to serve American needs for a considerable time to come.

Spain, Palestine, and the Soviet Union are other possible sources of potash for which forecast is difficult. But WPB believes that only a limited percentage of American needs can possibly come from

PARAPLY RUBBER LININGS



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abroad. European need for potash fertilizer may, in fact, exceed the supply for at least two years.

Industry spokesmen appear a bit skeptical whether they will be so long free from foreign competition. They indicate to WPB that domestic facilities are already functioning up to capacity. They thus feel that continued allocation will be necessary, at least for another fertilizer year, that is until early summer of 1946.

WALLACE, PATENT SALESMAN

SECRETARY of Commerce, Henry Wallace, is arranging to advertise through the Patent Office Gazette the availability of patents if the owners would like to sell or have them used by licensees. Wallace is also pressing the distinguished advisory board, which he named at the request of President Truman, to report by the end of June on needed patent legislation. If that board reports then, as expected, there will still remain the task of getting an administration policy to present to Congress. When President Truman sends his recommendations to Capitol Hill they will undoubtedly have prompt and careful consideration in the House. It remains to be seen whether the Senate Committee, which has refused any activity on this subject for several years, can be stirred into action. As there is a new chairman, Senator Pepper of Florida, there probably will be considerable action in the upper branch of Congress.

Experienced observers do not expect any comprehensive patent final legislation during this calendar year.

WPB LOOKING AHEAD

WAR PRODUCTION BOARD has announced appointment of reconversion chairmen for a large number of industries including chemicals. These officials will consult with their respective industries concerning problems relating to construction, equipment and materials. WPB will assist in meeting such problems, not solve them. This means that the industries must survey their difficulties, map their requirements and have their problems ready for consultation.

GUAYULE URGENTLY NEEDED

ALL THE domestic guayule crop will be harvested and processed in the next two years, says John L. Collyer, special director of rubber programs of WPB, to meet a shortage which makes it necessary to regard natural rubber "in pounds, not tons, from now on." The action is expected to produce 12,000 long tons of guayule rubber to be mixed with GR-S synthetic for certain uses.

Mr. Collyer says, "Our stockpile of natural rubber is in the danger zone—95,000 tons at the end of 1944 and estimated to fall to 55,000 by the end of this year—due to the demand for large combat airplane, bus, truck and implement tires." A few weeks ago S. T. Crossland, executive vice president of Rubber Reserve Co., declared that many factors indicate a continuing increase in rubber consumption for several years after the war.

Two guayule processing mills are in operation in California—one at Salinas and one at Bakersfield. Present plans call for two new mills at Bakersfield and two more at Patterson, in order to handle maximum tonnage by April 1947.

We need the guayule harvest now, must forego the ultimately higher yield in order to have rubber pending the reopening of the East Indies supply. Washington authorities say guayule rubber is substantially equal to the East Indies product for the use to which it is to be put.

GRAIN FOR CHEMICALS

DESPITE world food shortage, there will be plenty of grain for industrial processing during the next 12 months. The government has built a corn reserve in the form of a stockpile which already exceeded 20 million bushels out of an expected 50 million early in May. Thus the government expects that there need be no need of shortage of corn for wet grinding.

Wheat for industrial use, principally alcohol, will certainly be available for another year without difficulty as the supply for the present year reported by the government is practically equal to the all-time record. Consumption for alcohol use is currently at the rate of about 80 million bushels per annum, approximately 10 percent of total normal wheat disappearance in the United States. Exports of wheat for relief purposes in Europe and China will be large but limitation on ship space and facilities for deliveries on the two continents make exhaustion of reserves out of the question.

NITROGEN CONTROLS

MEMBERS of the industry advisory committee have been told the question of removing controls over nitrogen will be considered when definite information on supplies and requirements is available. At present nitrogen is in small supply with domestic requests running about 88,000 tons above available stocks. Requirements for liberated European areas are expected to be heavy. However, it is hoped domestic needs will be met more fully since two new projects, each with a monthly production capacity of about 5,000 tons, may soon be in production. Possible cuts in the munitions program also may ease the situation.

MINOR NEWS GLIMPSES

Textile chemicals are being used currently at less than peak rates despite tremendous unsatisfied textile demand. Estimates of textile production in 1945 indicate a decline of 18 percent in cotton and wool fabric manufacture from the peak rates of 1942 and 1943. The rayon fabric decline is 7 percent from peak. These figures give a good index of chemicals needs for these industries.

Refrigerant gas trade practices will be defined by Federal Trade Commission under a new code being currently formulated. The first step in code making was a series of discussions with the industry on May 25. FTC will still welcome comments on any marketing practice that should be covered by the code.

Wage differentials for evening and night shifts are definitely limited by War Labor Board controls. Some such proposals negotiated in California have been disapproved officially in top Washington offices as being excessive and tending to cause inflation.

Idle manufacturing capacity is being listed by WPB in order to facilitate renewed civilian manufacture. The board's Production Readjustment Committee will serve as a clearing house to bring together those who have surplus plant space and those who want it.

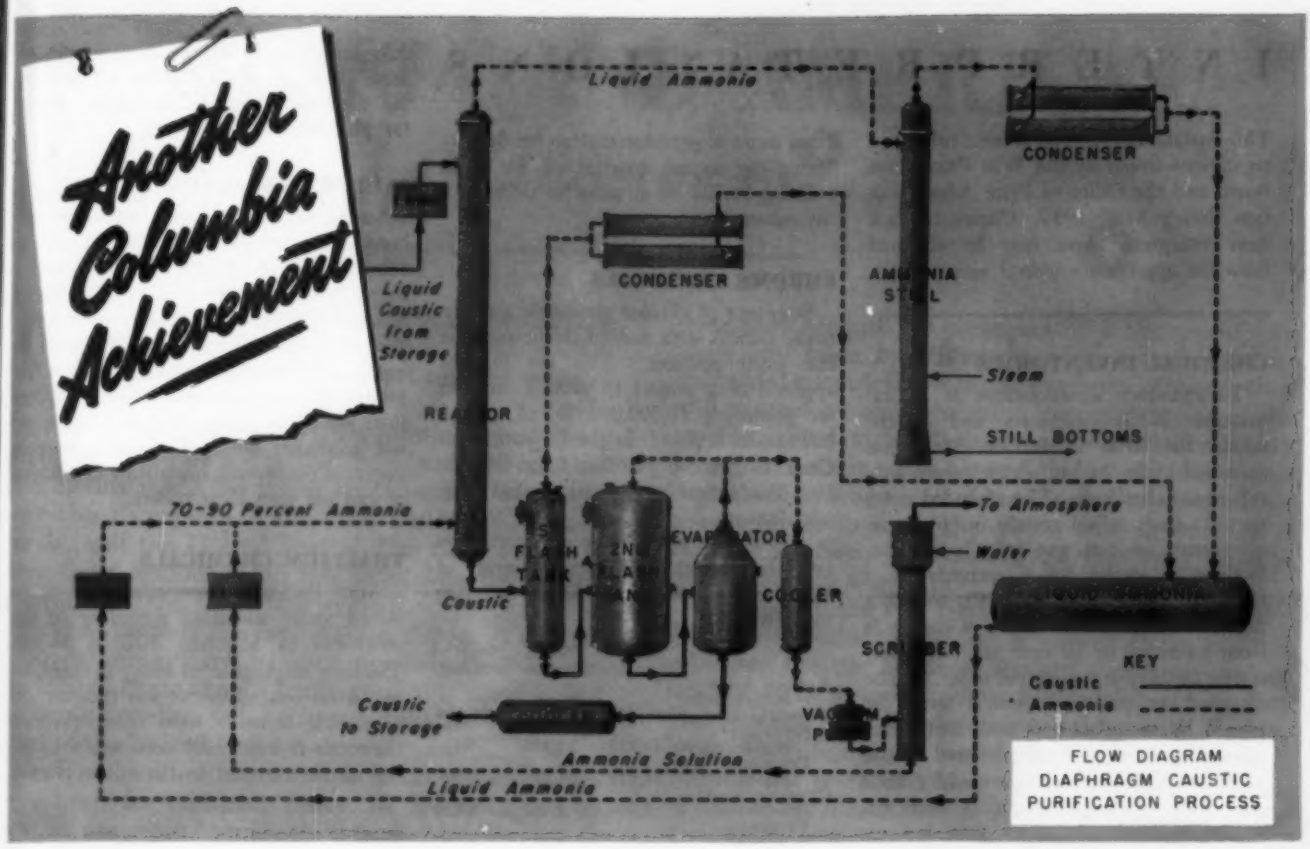
Foreign travel of businessmen to France and Switzerland became relatively easy in May. Other areas are being opened up promptly. Eastbound ship space is reported abundant and plane space available. Passports and visas can be had with almost prewar facility for those representing responsible American enterprise.

Deferment of "indispensable" workers for chemical enterprise is very little easier now than before V-E Day. Demand for able-bodied men of 18 to 29 continues, although older groups are certainly to be more leniently considered.

Veterans' rights to re-employment are much more vigorously expressed by the Veterans Bureau and Selective Service than was expected by most employers. Washington expects that some punitive action against reluctant employers may be used to show that the re-employment law has teeth.

Tin plate for containers will continue just as scarce for the balance of 1945 as during recent months. Washington sees no relief until tin again flows from Malaya.

Employer liability to wage earners was made more evident by two recent court decisions. The employee has no right to sign away his authority to sue for punitive damages on unpaid overtime wages, under one ruling. Under another, travel time is definitely authorized as a part of work time to be paid. The same principle is likely to be applied to wash-up or dressing time in a factory. In other words, the employer now must assume that work time begins and ends at the gate, not at the working place, under many circumstances.



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INTERPRETATIONS

This installment covers orders, rules and regulations issued by the War Production Board and the Office of Price Administration during May, 1945. Copies of each item interpreted here may be obtained from the appropriate federal agency.

CHEMICAL INVENTORIES

To PREVENT accumulations of critical materials in manufacturers' and dealers' hands, the War Production Board has amended Order M-340 which govern miscellaneous chemicals. The amended order specifies that, unless certain inventory requirements are met, any order by a manufacturer or dealer for a quantity of a chemical controlled by M-340, to fill a preferred order or to replace withdrawals from inventory to fill such an order, may not be certified as a preferred order. To be classified as preferred, orders must be placed by manufacturers and distributors when they have on hand preferred orders, as defined in M-310, that would reduce their inventories below an amount sufficient to meet deliveries that are expected to be made in the succeeding 60 days. However, 90-day inventories are permitted for the following chemicals: heat-treated rosins, stabilized rosins, polymerized rosins, metal resinates, and gum and wood rosins.

SPECIAL SALES LISTS

LISTS A and B of Priorities Regulation 13, have been amended thereby deleting some items. List A refers to domestic sales and deletions from the list include beryllium, rayon, paper mill machinery, and refrigeration condensing units and compressors. List B refers to export sales and deletions include beryllium, beryllium chemicals, lactic acid, calcium metal, dichlorodifluoromethane, monochlorodifluoromethane, and rayon. Fibrous glass textiles have been added to the list of items requiring WPB authorization for special sales for export.

PERCHLORETHYLENE

CLOSER control over deliveries of perchlorethylene has been made possible by tightening the reporting provisions of the schedule. The entire supply, used for metal degreasing, is reserved for military use. The new provision required suppliers to list the names of all customers ordering more than 3,500 lb. a month. Orders for less than 3,500 lb. are grouped and reported in terms of usage. The amendment further calls for a quarterly report on Form WPBO-3442, of stocks and consumption in order to check actual use and inventories of customers. This report is required from customers ordering 21,000 lb. or more of perchlorethylene for delivery during the second quarter and for those ordering 10,500 lb. or more for delivery in any subsequent quarter.

CHROME CHEMICALS

SUPPLIES of chrome chemicals are relatively critical with sodium bichromate in the worst position. This has brought approval of a project to provide facilities for producing 10,000,000 lb. of sodium bichromate a quarter in the Defense Plant Corp. magnesium plant at Lake Charles, La. Production is expected to start early next January.

Allocations of chrome chemicals as estimated by the Chemicals Bureau of WPB are as follows, the figures referring to 1,000 lb.:

	Second Quarter	Third Quarter	Fourth Quarter
Sodium bichromate			
Production ...	34,890	34,590	38,990
Screened requirements	43,385	43,185	—
Proposed allocation ..	34,649	34,210	—
Chromic acid			
Production ...	4,300	4,600	4,600
Proposed allocation ..	4,588	4,588	—
Potassium bichromate			
Production ...	1,700	1,700	1,700
Proposed allocation ..	1,688	1,688	—
Chrome tanning compounds			
Production ...	6,670	7,700	7,700
Proposed allocation ..	6,670	7,700	—

Because of high military requirements, a one-time report is required from all persons who used between 450 lb. and 4,000 lb. of sodium bichromate last April. WPB also requires such a report from persons who did not use this amount during April but who use such a quantity in any following month.

PHOSPHATE PLASTICIZERS

AMENDMENTS to Schedules 61 and 63 of Order M-300 requires producers requesting allocations of phosphate and phthalate plasticizers for insulation of wire and wire cable to specify the type of wire for which the material is required. It was explained that these plasticizers are in small supply due to the shortage of phthalic anhydride. At the same time dicarbitol phthalate was placed under control of Schedule 63 of M-300 with initial allocations to date from June 1.

INSECT REPELLENTS

EFFECTIVE June 1, benzyl benzoate and benzyl chloride have been placed under allocation according to Schedule 105 of Order M-300. Increased Army requirements for insect repellents is responsible for the directive. Benzyl chloride is used in making benzyl benzoate which in turn is used as an insect repellent, miticide and delousing spray. The entire supply of these chemicals is now going for military use with the exception of limited stocks for pharmaceutical purposes.

SALT WATER SOAPS

SHORTAGE of salt water soaps for the Navy has brought an amendment to Schedule 44 of M-300. This adds two soaps, Syntex M and VEL, to the list of allocated detergents. At the same time, allocation procedure was simplified in order to reduce the paper work. Only producers are now required to file applications for allocations. Suppliers who are not producers file applications with producers as consumers, submitting certificates of end use with their orders.

THALLIUM CHEMICALS

ALL thallium chemicals have been placed under allocation according to the provisions of Schedule 107 of M-300. Thallium sulphate is in heavy demand for use in rat control in the war theaters and because it is made from other thallium chemicals it was found necessary to apply the restrictive order to the entire group.

PRICE CHANGES

REQUESTS for higher ceiling prices on gum rosin met with an unfavorable response. OPA decided that existing ceilings are well above the minimum required, are far above peacetime levels, and are high enough to yield to the great bulk of the industry a margin over cost that should be adequate to permit full production.

Increases in some producers' ceiling prices for pine tar, pine tar oil, pine oil, pine wood charcoal, turpentine, dipentene, pitch and similar products have been officially authorized. Increases will be through individual adjustments for those producers who are unable to operate successfully under existing maximum prices.

On sales of totaquine by Defense Supplies Corp. to any United States or foreign government agency or to industrial users for use in fulfilling contracts to such agencies, a ceiling price of 95c. an ounce has been established. On sales for civilian use the existing ceiling of 42c. an ounce continues to apply.

Because of increases in wages of miners, ceiling prices for beehive oven coke produced in the Connellsville district have been raised. Increases are 25c. a net ton for coke produced in hand-drawn ovens and 50c. a ton where produced in machine-drawn ovens.

To assure continued range feeding, base prices for sized cakes and pellets produced from soybeans have been raised to $47.25 a ton, an increase of 75c. a ton.

Producers of building, chemical and industrial lime in specified states have been granted an increase of 65c. a ton over previous f.o.b. plant prices.

RUSSIA AND AMERICA

ALLIES—or else . . .

VICTORY in Europe was won only through the combined endeavor of the United Nations. Only through sustained joint effort can the fruits of that victory be reaped.

Without disparaging the truly heroic contributions of others, three of the Allies may fairly be credited with having made the major contributions to victory over the European Axis—the United Kingdom, Russia, and the United States. The close accord of these three nations is no less crucial to the accomplishment of the tasks that remain.

First of these is the war against Japan. It still requires winning. Even without any help from others, the United States could make good this victory, but the war's duration will be speeded by the marshaled effort of the United Nations.

Next, and not less important, is the task of establishing a basis for enduring peace. In this struggle our enemies are more formidable than any we have faced—national ambitions, prejudices, suspicions and distrusts, the staggering burden of tradition and debilitating cynicism born of past failure, the cleaving wedges of divergent languages, thought patterns, economic creeds and procedures—an array of difficulties as baffling as fog and as formidable as a deluge. They can be vanquished only by a continuance of the working accord between the United States, Russia, and Britain that was forged on the anvil of European conflict.

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This high appraisal of the decisive importance of the Big Three in determining the destiny of the United Nations organization, in no way depreciates the importance of the role to be played by France, by China, or the other freedom-seeking nations represented at San Francisco. All of us are committed to the building of a genuinely representative security organization in the conviction that by such means alone can we possibly achieve a just and lasting peace. But the strength of any international machinery will depend upon the validity of Russian-British-American cooperation. If these three are able to achieve substantial harmony of aim and procedure, a world organization that includes them can operate with effective coherence. If they pull apart, the United Nations will break up into competing and jealously hostile blocs.

This is inevitable because of the sheer weight of these three nations in the world's affairs. Between them they account for perhaps half of the world's income and from two-thirds to three-quarters of its industrial output. Once Japan has been crushed, they will control an overwhelming preponderance of the world's armed might. Each of them will wield military power on a scale quite beyond the power of any embryo security league to hold in check. Only if all three are resolved to keep the peace and to enforce it through the Security Council, can that body hope to accomplish its aim.

Although there is a tendency on both sides of the Atlantic to indulge somewhat recklessly in mutual criticism, the ties between Britain and America are too firm to be severed by any foreseeable strain. But that has not been true of our relations with Russia. Even while fighting a war in which our respective ways-of-life were at stake, the inestimable services of each to the other were rendered as friendly but independent associates rather than as fully trusted partners. Now again, as we approach the difficult and vitally important task of building a world organization and of devising a European peace, the task of our delegates is complicated by national attitudes under which each hopes for the best from the other, while fearing the worst.

But the stakes for us both—and for the rest of the world—are too high to be played for in a diplomatic poker game. Russia has no inhibitions in demanding what she wants, and our own vital interests must be stated and upheld with undeviating firmness. Yet we both must face the stark fact that few advantages that either nation might gain at the cost of dissipating the good will of our wartime association could be worth the price thus paid.

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The first steps toward establishing confidence lie in a frank recognition of what may contribute to the lack of it and in a definition of what can be done to restore it.

1. *Probably the greatest single area of reciprocal distrust between Russia and our own country is based on the fear of each that the other may try to interfere with its domestic, economic, and political affairs.* Each purports to see the beam of meddlesome intervention in the other's eye, while it ignores the mote in its own. Thus the Soviet Union remembers that we participated in the foreign military intervention at the time of her civil revolution, and afterwards lent our support to successive boycotts of her trade, of her gold, and of her credit needs. For our part, we remember the Soviet Union's doctrine, and

aggressive support, of revolutionary international communism.

We feel that Russia should find satisfactory evidence of our present willingness to have her develop her internal institutions as she will in the aid that we have given her during the war, and in the record of our good-neighbor policy as applied to Latin America. She, no doubt, resents our lingering suspicions in the face of her declared policy of 1941 to refrain from any attempt to influence the political or economic structure of foreign nations. Certainly, each of us will need the repeated reassurance that can come only through sustained performance by the other in the years ahead. Meanwhile, much will be gained if each will give to the other's good faith the benefit of the doubt, while it scrupulously guards its own conduct to avoid even the appearance of backsliding.

2. *A second zone of suspicion is created by those measures which each of us interprets as natural and necessary bulwarks of national security when they are our own, but as evidence of dangerously aggressive imperialism when taken by the other.* In our view, at least, such demands as we have voiced for island trusteeships or for other naval bases appear mildly conservative as compared with Soviet claims for annexation of territory and for a general orbit of influence, under governments friendly to her, throughout eastern Europe in particular.

There can be no easy solution to that problem. Bi-focal vision, by which one nation can look through a second lens ground to the prescription of another, seldom is achieved in international affairs. The success of the San Francisco Conference will provide a mechanism for international definition of principles and procedures which at least might relieve the inevitable strains. Most important will be the record of how each of us proceeds in our respective courses of action. Soviet performance thus far is highly unsatisfactory to us. While we have taken pains to clear our procedure with her, she has taken action in the Baltic, in Austria, and in Poland without even advance notice to us.

A major test of our ability to cooperate may be found in the Allied administration of conquered Germany. The proposed four-headed control of a four-way partitioned nation promises to be at best an extremely awkward mechanism of administration. At worst, it can result in continuous and dangerous bickering between the representatives of Britain, France, the United States, and Russia in the Berlin coordinating center, and in hopelessly divergent procedures in their several zones of administration. There will be a compelling need for all of us to exercise all of the wisdom and cooperative resolve that we possibly can muster.

3. *A third testing ground for the future of American-Soviet relationships will be defined by the course of Russia in our continuing war with Japan. We are not unmindful of the toll paid by the Soviet Union in its magnificent European war effort. But we still are locked in a desperate struggle with an enemy that exemplifies the Fascism which America and Russia equally denounce. And that war is being fought in an area where Russian interests are importantly at stake.*

Russia has an extraordinary opportunity to create good will by throwing her weight speedily and effectively on our side. There is no doubt but that the final Pacific settlement will generate problems comparable with those of the European peace, but it is equally certain that the continuation of the European comradeship in arms can do much to promote an enduring and confident postwar friendship.

4. *A fourth, and highly important, potential source of suspicion and irritation is the intellectual blockade that the Soviet Union has maintained against the free flow of travel, intercourse, and exchange of ideas.* We can understand the genesis of this policy and the reasons for its continuance while Russia entertained a constant fear of attack by powerful enemies. But the sustained perpetuation of such a quarantine by so strong a nation as the present U.S.S.R. could not be accepted as a protective measure. Inevitably it would generate suspicion that it was rather an instrument of nationalistic isolation or even of contemplated aggression. A way-of-living, at arm's length, with a nation that maintains such intellectual quarantines is possible; any whole-hearted partnership of effort is quite impracticable.

5. *Trading between a free-enterprise nation and one that operates all foreign commerce as a government monopoly can give rise to many frictions.* That subject is too complicated for exposition here. Suffice it to say that, while difficult, it is not impossible to conduct such trade with mutual advantage. We are in a position to help Russia greatly with her program of industrial rehabilitation and expansion at great saving of cost in terms of her current scale of living. In return, we must have assurance that her government monopoly trading will be conducted for commercial rather than political ends, and that it will be used to encourage rather than to restrict multilateral and non-discriminatory world trade.

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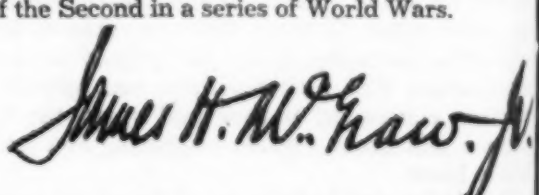
This is a representative list of the major areas in which misunderstanding and distrust may be generated, or allayed, in Russian-American relationships. No doubt, an equally honest list drawn by a citizen of the Soviet Union would be more heavily weighted by those features of our behavior which irritate and stimulate distrust on their side. If such a catalog were to be presented, it should receive our most searching and responsible consideration.

For it is of utmost importance that our two nations, in concert with the other United Nations, learn how to get along in mutual confidence and respect. Our understanding of each other now is so imperfect that our negotiations are punctuated with continuous irritations over *little issues*. This, inevitably, will continue until such matters are submerged in the general confidence that can be achieved only through satisfactory settlement of the *big issues*. We must succeed in this, or the defeat of Japan will merely mark the end of the Second in a series of World Wars.



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CHEMICAL
& Metallurgical
ENGINEERING

ESTABLISHED 1902 — S. D. KIRKPATRICK, Editor

JUNE 1945

Germany Is Still Our Problem

LAST month this page was written in London as the great clock of time was about to strike Hitler's doom. Since then we have had an opportunity to spend a couple of weeks in Germany and to study at close range some of the problems that have come in the wake of our victory in Europe. Because they necessarily affect our own technology and industries we believe them worthy of discussion, even though their ultimate solution may depend on developments that cannot yet be forecast.

One of these problems arises from the fact that the German chemical industries were not as completely destroyed as many of us had hoped or believed. From our observations in the Rhineland, Ruhr and Saar, we would estimate that even the most heavily bombed chemical plants were capable of being put back into operation within a matter of a few months. Not only did the Germans become adept at making these emergency repairs, but they had learned to modify their processes and equipment so that a bomb or incendiary did a minimum of permanent damage. Some chemical plants escaped entirely, although for the purposes of war their operations were just as effectively paralyzed by the destruction of transportation facilities.

Management in all of the plants we visited was willing and anxious to resume production. Some were holding onto their key technical and operating personnel, paying out salaries and wages from their own funds. When asked to make estimates as to what chemicals these plants could produce, and when, the figures given by the German officials were really startling, certainly so when compared with what we might visualize as the maximum requirements of our military forces and of Germany's essential civilian economy. The natural question is whether these plants will be permitted to manufacture for export, either on a commercial basis or for payment of reparations due the Allied governments. In either event the decision must necessarily affect plans in this country for continuing or developing new markets for American chemicals in India, Russia and China.

Another problem arises from a threatened export of German "brains." After the last war a number of American manufacturers rushed into Germany to hire the best of that country's research scientists and engineers or to license their patents and secret processes. This time there may be some hesitancy about entering into any alliances with foreign cartels, but presumably the Department of Justice would not interfere with the bona fide employment of a German scientist or technologist. However, we have reason to believe that the Allied governments, through their control councils, will have something to say about any such traffic. Already there are reports that there are I. G. engineers in Spain who are known to have with them plans and specifications for building new chemical industries. Thus even if exports are banned or drastically restricted, it would still be possible for Germany to continue to dominate certain friendly markets for her goods.

We have no solution for these problems except to say that they belong quite properly in the jurisdiction of the American Control Council that has now been set up under Generals Eisenhower and Clay. Nor have we any reason to believe that these men are unaware of them or of their importance to American industry. In establishing their control policies they can make certain that chemical plants, even those only remotely associated with the potentialities for making war, are not permitted to resume operations on a scale that would threaten or destroy industries in the Allied countries. In the case of plants making explosives and other chemical munitions, the Control Council has an obligation and responsibility to see that this dangerous capacity is effectively dismantled or destroyed. Only through most vigorous policing and intimate control of chemical industry can the Control Council be sure of Germany's permanent disarmament.

Fortunately, the Army and Navy, as well as the various war agencies of our government, have already anticipated industry's demand for technical information obtained from captured plants and laboratories of our enemies. There are at least five hundred civilian investigators in Germany today who are seeking to learn of new advances in science and technology that can be applied in war industries. The information and data so obtained are the rightful property of the American people and should be made available and utilized by them without selfish advantage to individuals or companies. This, it seems to us, is a much fairer procedure than permitting any one or group to indulge in the wholesale importation of German brains.

Our problems in Germany did not end with V-E day. Our Armies have done well their job of winning the war. Can we, through the Allied Control Commission, do equally well in winning the peace?

SIDNEY D. KIRKPATRICK *Editor, Chemical & Metallurgical Engineering*

THROUGH GERMANY IN A JEEP

Impressions gained in a recent journey to some of the principal chemical manufacturing centers in those sections of western Germany now under military government by American forces.

The author starts out blithely from Reims for his jeep journey into Germany

BACK in 1936, at the conclusion of the International Chemical Engineering Congress in London, about twenty members of the American delegation paid visits to important chemical centers in western Germany—at Leverkusen and Ludwigshafen, Frankfort, Darmstadt and Heidelberg. Those were days when in misguided enthusiasm we sought to promote friendship and understanding between the two leading chemical countries of the world. Today those plants and cities are again being visited by American chemical engineers, but this time under different circumstances and for quite a different purpose.

Our investigators seek to learn what they can of any advances in German technology that may be useful to us in the war with Japan. They are after the basic facts and figures that will help in permanently disarming German industry and promoting its effective control by our military government. Some day much of the information so obtained may possibly be published by official sources for the benefit of Allied industry and technology. Meanwhile, *Chem. & Met.* readers may be interested in some personal impressions and non-technical observations made by its editor during a 1,500-mile journey through this same territory in one of the Army's famous jeeps.

Late in April while serving at the American Embassy in London as one of the chemical representatives of WPB, the writer was ordered to Germany to investigate a certain chemical industry. Since there was urgent military need for its production, highest air priority was provided and other necessary transportation facilities were immediately made available. In almost three weeks—from April 24 to May 12—about 2,500 miles were covered, a thousand miles by air transport, cub plane and bus, and the remainder by jeep and trailer. Such travel today over French and German roads helps to shake down one's thoughts, impressions and conclusions. What are they?

First, as we swung from France into Germany via Luxembourg, one is struck by roadside evidence of the many battles that have been fought and refought over these military highways during the past five years. Abandoned German and Allied tanks and other army vehicles become more frequent. Signs warn you that the highways have been cleared of mines only as far as the ditches. Factories, bridges and railways show the effect of Allied bombing and artillery fire. But not till we reached Coblenz, however, did we see the results of mass destruction. There the only highways were the narrow roads that the bulldozers had pushed through the rubble and ruin. There is no traffic on the Rhine, for not only are all the old bridges down, but the river course is blocked in many places by wrecked ships and barges. Already this has created a problem in obtaining coal for power and industrial uses.

Pushing north along the Rhine we had an opportunity to see the famous old bridge at Remagen and the equally famous pontoon bridge our engineers had built alongside of it. The old university city of Bonn provided comfortable billets and an opportunity to look at some of the undamaged dormitories and laboratories now occupied by American troops. Bombing here had been less severe, presumably because of the absence of any important industries.

That was not the case in Cologne. For literally a square mile around its famous cathedral there is not a single inhabitable building nor any one left to inhabit them. How the great church escaped with only minor damage is a miracle that may in part be explained by a crude sign painted by some wisecracking GI: "You are now looking at Cologne Cathedral through the courtesy of the U. S. Air Forces." The old Domhof, which had been the meeting place of the American chemical engineers prior to our visit to Leverkusen in 1936, is now just a pile of rubble.

Work kept us in the vicinity of Cologne

for several days, and we had an opportunity to see a number of plants. The great carbide and cyanamide works of A. G. für Stickstoffdunger at Knapsack were badly hit, but some of the turbines were still spinning and one or two of the cyanamide furnaces were in operation. As a matter of fact, this was one of the very few German plants that were actually in production at the time of our visit. In the carbon black plant (Werk August Wegelin, A.G.) of Degussa at Kalscheuren, damaged principally by artillery fire during the American invasion, workmen were cleaning, bagging and shipping some of its precious stock to be used in making military tires for the Allied Governments at Liege. Full-scale production cannot be resumed until coke-oven gas can be obtained from the nearby network. Incidentally, Germany has a most elaborate system of interconnected gas lines in the Ruhr, Saar and Leipsig areas.

Crossing the river at Cologne on a newly completed pontoon bridge, we made a short trip down to Troisdorf to see the I. G. plastics and explosives plant of Dynamit, A. G. (vormals Alfred Nobel Industrie). Here the main offices and laboratories have been completely destroyed by bombing, but there was only slight evidence of destruction in the works proper. Perhaps this is to be expected because an explosives plant is naturally designed to be explosion-proof and Troisdorf was said to be Germany's largest producer of timers and detonating caps.

Our biggest surprise was to come later that afternoon at the great Bayer works of the I.G. at Leverkusen. We had been led to believe that this huge plant was almost completely destroyed. Instead we found it in remarkably good condition. Bombing damage had been largely confined to a rear area of the works and to the beautiful casino and Düisberg gardens where the American delegation had been so lavishly entertained in 1936. A most modern five-story building for research and development work on buna, completed during the war, seems to have escaped all damage. In it we were shown elaborate equipment for analysis and testing of synthetic rubber products as well as a complete pilot plant for tire production. Dr. Conrad, who heads the buna department, had just received permission from the American military government to complete the processing of some 40 tons of buna to be made into tires for our jeeps. The specific information we desired was obtained quickly and satisfactorily, but as we left the plant a group of American investigators were moving into the headquarters office for ten days of detailed study of records and equipment.

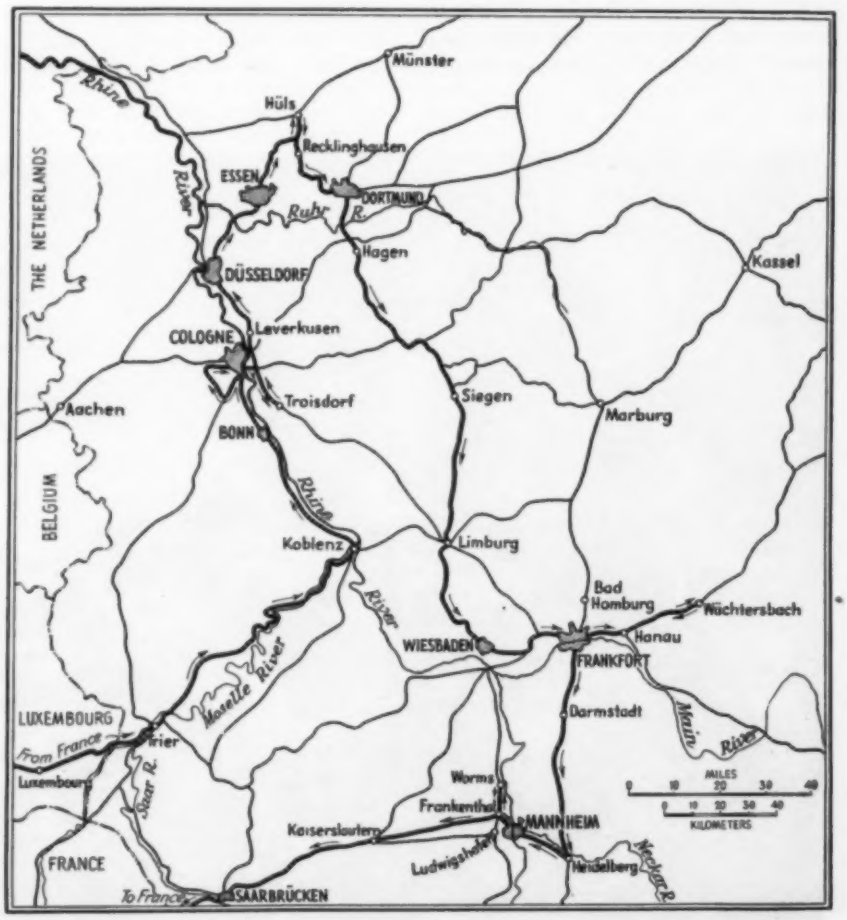
Traveling north through Düsseldorf and Düisburg to Essen brought home to us the very thorough job done by the Allied air forces in their mass bombing of these congested industrial areas. This sample of what the Japanese have coming to them certainly left no doubt in our minds about the effectiveness of this means of bringing our enemies to their knees. From a very narrow and selfish viewpoint, however, we were pleased to find that the bombers, while rendering untold damage to the great Krupp steel and munition works, had somehow managed to leave the company's famous guest hotel in a very livable condition. The obliging military government provided comfortable billets, a good, warm meal, and even a bottle of Rhine wine marked "Reserved for the Wehrmacht."

The next morning we pushed on beyond Recklinghausen to the I. G. Bunawerke at Hüls. Here an effective job of camouflaging, employing literally acres of netting and artificial foliage, may possibly have helped to protect the plant for we could find little or no evidence of damage by bombing. Nevertheless, it had been effectively put out of business by paralyzing the transportation system on which it depended for its raw materials. At Hüls we found in charge a young German engineer who reminded us that we had last met in the Jasco process plant at Baton Rouge, La. He seemed particularly pleased to tell us that the I. G. electric-arc acetylene-from-methane process, which had failed to operate successfully in America, had since been perfected and made to yield raw material for butadiene. The carbon black obtained as a byproduct, however, is not as satisfactory for buna rubber as that made from naphthalene and anthracene in the Degussa plants. Incidentally, this small northwest corner of Germany near the Dutch border is the only area in which natural gas is available, with the possible exception of a small production around Hanover.

Turning south we picked our way back through the heavily bombed industrial city of Dortmund, where we visited another larger and more modern carbon black plant. Jointly owned by Degussa and several of the large German tire manufacturers, this plant had produced a high quality product using anthracene oil and coke-oven gas as raw materials. (Perhaps in a later article the writer will be permitted to describe in greater detail this interesting, although from our standards uneconomical, process.)

We had to go back almost to Bochum to find a passable bridge over the Ruhr, and after we finally left Hagen we ran into a May-day snowstorm in the Lenne and Rothhaar mountains. There were no side curtains on our air-conditioned jeep, so we were really ready for a warm meal

A circle tour of chemical centers in Germany's Rhineland, Ruhr and Saar



and hot baths when we turned in for the night in a requisitioned German home near Limburg. The next morning we were in Wiesbaden in time for lunch at the officers' mess, but urgent business in Frankfort prevented a side trip across to the Hoechst dyeworks at Mainz, which looked most interesting and inviting on the horizon. Later we learned that it too had not been bombed as severely as the plants in the Ruhr.

DAMAGE AT FRANKFORT

The old "Innerstadt" at Frankfort is almost completely gone. The famous "Rathaus" (city hall) and the Roemer building that from 1400 to 1800 had been the scene of the election and coronation of all Germany's emperors is now in shambles. The offices of Metallgesellschaft, which some of us visited in 1936, now house the very efficient U. S. Military Government. The great ten-story thousand-room "Hochhaus" of the I. G. seems to have escaped with only a few broken windows which are now being repaired for a new set of occupants. Degussa, Germany's second largest chemical company, and Hiag, its wood-chemical subsidiary, were completely bombed out of Frankfort and the officers had moved their headquarters to the company's research laboratories in an old castle near Wächtersbach.

The famous Reichsautobahn to Darmstadt and Heidelberg had too many downed bridges and crossovers, so we took the old road which gave us an opportunity to look in at Merck's and to pass the old Technische Hochschule where Prof. Ernst Berl (now of Carnegie Tech) once held a distinguished chair. Then on to beautiful Heidelberg, said to be the only large city in Germany that was left untouched by the bombers. To be sure, the old bridges over the Neckar had been blown up, but presumably that was done by the Germans themselves. Streets were crowded and everyone seemed to be in a happy mood for this was on Monday, May 7, and the war in Europe was nearer over than any of us realized.

From what we observed, Heidelberg seems destined to become a center of scientific inquiry. We met many American investigators who were studying records and documents that somehow seemed to have drifted naturally to this once important haven of literature and learning.

Ludwigshafen and Oppau—the prewar sites of Germany's largest and most diversified chemical industry, present a mixed and confusing picture. As is evident from the accompanying aerial photograph, taken on April 9, and the one on the front cover of this issue of *Chem. & Met.*, these plants did not escape several severe pastings from our own bombers. Yet as we drove through the gate and parked our jeep at the point marked "X," things didn't look too bad. At their desks in the large office building, at the left, were all the principal members of the technical staff, willing and anxious to assure us that large scale production of literally hundreds of chemicals could be resumed as soon as coal could be brought in from the Ruhr. Capacity figures were cited that were really startling when compared with the needs we visualized for military and essential civilian requirements in Germany. No production was under way at the time of our visit, but we watched the shift change and saw several hundred workers leaving the plant to find their way to their ruined homes. Their work, we were told, was confined to cleaning up and repairing the plant to make it ready to resume operations when fuel and certain raw materials again become available.

V-E DAY IN FRANCE

A hurried trip to the small Degussa carbon black plant of Carl Hisgen, A. G. at Wörms, a none too inviting billet in Frankenthal, and then on Tuesday, May 8, V-E Day, we were on our way back to France. The French flags, with the Lorraine cross of the Free French, were flying by the time we crossed the Saar at Saarbrucken. At Metz we lunched with some returning prisoners—among them a young Canadian pilot on a Spitfire who had lost almost a third of his weight in walking 500 miles from eastern Germany to a camp near Munich where he had been liberated by an American Army task force. He had more reason than did we to be glad we were on our way home. Hurrying on, we reached Verdun just in time to hear the Prime Minister's historic broadcast. Over those remaining 90 miles to Reims we almost flew for we thought we knew what sort of celebration was in store for us in that famous city where the surrender had occurred but a few hours before our return. Suffice it to say here, we were not disappointed.

Such was the very satisfying climax of a most interesting and enlightening experience. In two weeks we had visited a dozen plants and talked with more than a hundred German chemists, engineers, executives and workmen. Our Army has done well its job of winning the European war. Can we do as well in winning the peace?

How the I. G.'s huge plant at Ludwigshafen looked from the air on April 9, 1945. Official photo by Major Randolph Hawthorne, Eighth U. S. Air Force. "X" marks the spot where Editor Kirkpatrick parked his jeep

C. K. TSENG *Scripps Institution of Oceanography, La Jolla, Calif.*

COLLOIDS FROM KELP

Give Rise to a Unique Process Industry

Processing of colloids from seaweeds has grown, largely within the past decade, into a sizable chemical industry in this country, yet little technical information on this subject has ever been published. Tonnage-wise, most important of the seaweed colloids is algin, now produced from kelp by two basic processes. Because of their unique properties, the alginates have been finding expanding usage in industry; indications are that this trend will continue.—*Editors*

IN PRESENT-DAY USAGE, the term kelp refers to seaweeds of the brown algal order *Laminariales* with large, flat leaf-like fronds. Still occasionally used erroneously to refer to seaweeds in general, the word originally referred to seaweed ash, an important source of soda and potash in Europe during the 18th and early 19th centuries. Scotland alone produced annually as much as 20,000 tons of kelp ash. In addition, the world's supply of iodine was largely derived from seaweed until the Chilean nitrate deposits and certain brines became important sources of this chemical.

A similar kelp industry was born during World War I, when this country was striving to obtain a supply of badly needed potash from the giant kelp of California, *Macrocystis pyrifera*. This seaweed also served as a raw material for making acetone by a unique fermentation process. However, the use of kelp as a source of potash, iodine and acetone was abandoned soon after the close of the war and commercial extraction of these chemicals has never been revived in the United States. Only in countries where the living standard is much lower, such as in Japan, can such operations become profitable.

The first seaweed extensively utilized in America was the Atlantic red alga known as Irish moss. Since 1847, this has been harvested regularly for food and certain medicinal and industrial uses. Only in recent years after its colloidal extract, carrageenin, had found extensive uses in various food industries, did the Irish moss industry become firmly established. In the 1920's, the United States gave rise to two other seaweed industries: an agar industry* and a revived kelp industry manufacturing algin. Both were based principally on California seaweeds.

Agar and algin, like carrageenin, are colloidal substances valuable for their unique properties. Algin is important as a suspending, thickening, emulsifying, stabilizing, and water-holding agent. Thus, with the exception of a few firms producing kelp meal for stock feed and pharmaceuticals for human consumption, the present-day American seaweed industry is essentially concerned with the extraction and purification of these seaweed colloids. Fig. 1 shows such colloids now produced commercially in this country, the seaweed from which each is derived and the approximate annual production. The principal commercial producers of these and related seaweed products are listed in the accompanying table.

Contribution from the Scripps Institution of Oceanography, New Series, No. 256.

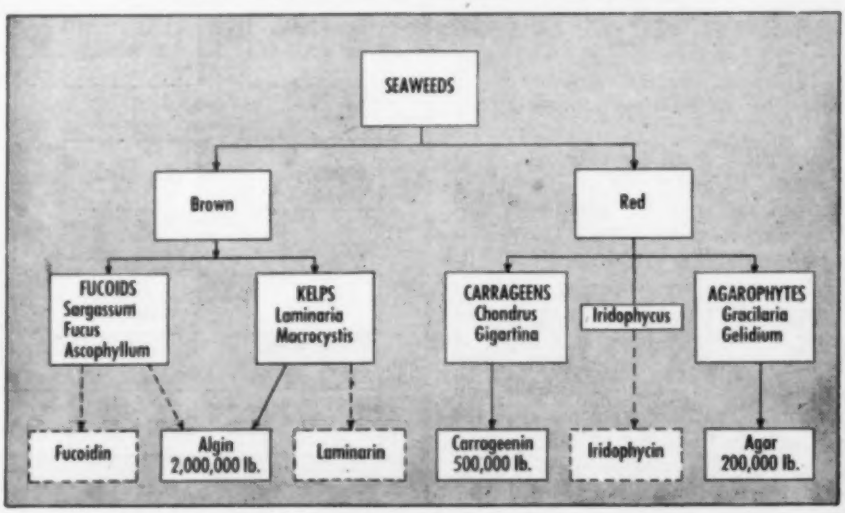
* A series of articles on the American agar industry appeared in the January, February and March 1945 issues of *Food Ind.*—*Editor.*

AMERICAN ALGIN INDUSTRY

In commerce, the term algin refers specifically to soluble alginates, especially sodium alginate and to a less extent, ammonium alginate. In a broader sense, it is used as a general term to refer to all alginous products, the acid as well as its salts. Being chemically unstable, alginic acid itself has few direct uses in industry. The most useful alginous compound is sodium alginate, although the ammonium and calcium salts are also produced commercially in large quantities.

The algin industry in this country was founded at San Diego, Calif., in 1926 by a firm which, after a few changes of name, is now known as the Kelco Co. By virtue of its intensive research and development work, this firm made considerable improvements in the manufacturing processes, de-

Fig. 1—Colloids now produced commercially in this country with the approximate annual production of each; products of possible commercial value which might be produced are indicated by broken lines



veloped new uses for its products, especially as a stabilizer in making ice cream, and achieved commercial success. It is responsible for the great majority of the algin output in this country and is probably the largest algin producer in the world.

Another firm, established about six years ago as the Algin Corp. of America, has its plant located at Rockland, Me. Like the West Coast concern, this firm produces a highly purified algin. Crude alginous products are made by two other firms especially to serve in feed-water treatment.

United States production of algin in 1941 was estimated by Scheffer (*Fishery Market News*, June 1943, pp 1-6) to be worth $1,500,000, representing probably about 2,000,000 lb. The algin may be in the form of crude products selling for as low as 5c. per lb., alginous pastes for water treatment selling at 7c., and as pure algin selling at $0.80-1.00 per lb. Production data since the outbreak of the war have not been released. It is believed that because of the war requirements, algin production has greatly increased.

HARVESTING KELPS

On the Atlantic Coast of America and Europe, two kinds of kelps are utilized: the horsetail (or digitate) kelp, *Laminaria digitata*, and the broadleaf (or sugar) kelp, *Laminaria saccharina*. These are harvested with a grapple hauled at a depth of 12-15 ft. by a power boat. To a lesser extent, they are obtained by hand dragging from a dory. The harvesting season extends from June to December.

Macrocystis pyrifera is the only kelp used by the Pacific Coast industry, although there are three other giant kelps worthy of being exploited. The *Macrocystis* is truly a "giant" kelp and is undoubtedly the largest seaweed known, growing to over 100 ft. in length and forming extensive beds several square miles in area. It has been estimated that more than 30,000,000 tons of fresh kelp could be harvested annually on the Pacific Coast south of Point Conception, Calif. This figure appears to be much too high, since the highest annual yield so far was only 394,974 tons in 1917. At present, probably about 60,000 tons are harvested annually in this area.

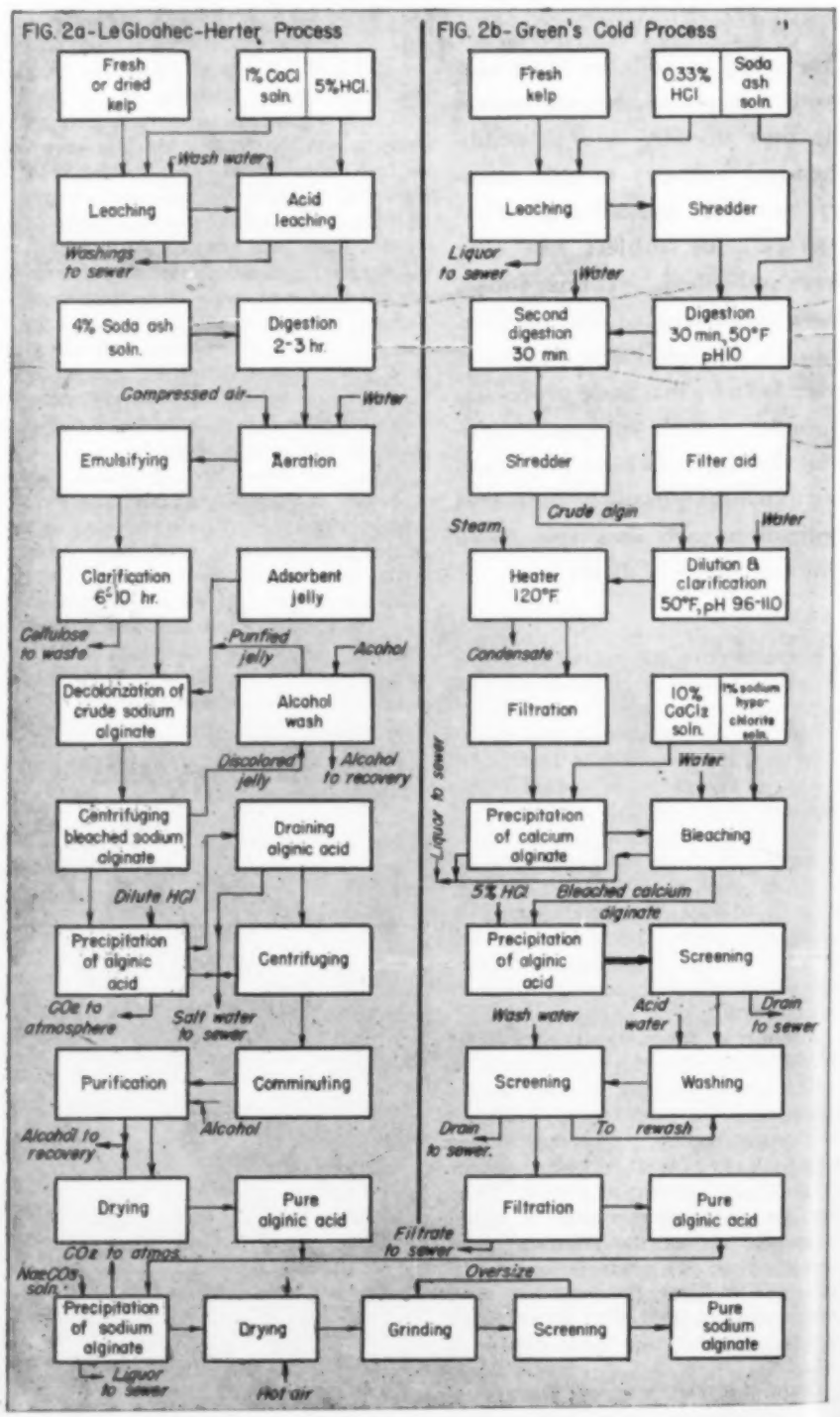
Early methods of harvesting the giant kelp were inefficient and required much human labor until the mechanical harvester was developed. This machine, a major contribution to the success of the Pacific kelp industry, is a motor run barge equipped with a modified mowing machine having a horizontal blade at a depth of about 4 ft. below the surface of the water. An endless chain elevator hoists the kelp on board. The harvester is placed in the bow, with the blade cutting directly ahead of the boat. The knife, generally 10-20 ft. wide, is considerably shorter than the beam of the boat. The elevator, which is as broad as the swath, has its lower sprocket wheels immediately back of the cutter bar. It is driven at rather high speeds so as to pick up the cut kelp before the waves wash it away. A knife at each end of the elevator and parallel with it serves as an edging device to cut the kelp clear at the sides.

A barge of this type can harvest as much as 300 tons of fresh kelp at a single load. Harvesting is carried out on the Pacific Coast in calm weather throughout the year. By cutting the beds in rotation, these can be worked periodically to assure a sustained yield.

Since the discovery of algin was reported by the English chemist E. C. C. Stanford in 1883, it has been manufactured essentially by the same basic principles: extraction of algin by alkali and precipitation of alginic acid with a mineral acid.

In Stanford's original "wet" process, kelp was treated with cold water to dis-

Fig. 2—Generalized flowsheets of the two basic processes now used in this country for the manufacture of alginic acid and algin



solve the potash, iodide and other soluble inorganic salts. The residual kelp was then digested either cold or warm for 24 hr. with 10 percent of its weight of soda ash. The resulting glutinous mass was filtered to remove cellulose and foreign material. Hydrochloric or sulphuric acid was added to the filtrate, precipitating alginic acid in light grey, gelatinous flocs which were washed and pressed in a wooden screw press to a compact cake resembling new cheese. Sodium alginate was obtained by soda ash treatment of the alginic acid. When dried, it was in the form of thin, almost colorless sheets that resembled gelatin but were very flexible.

An interesting and unique process was used by the Hercules Powder Co. in San Diego during World War I. Kelp was fermented to obtain calcium acetate and critical acetone. The unfermented portion of the kelp was then used for the manufacture of algin by a procedure similar to the original Stanford process. Potash and iodine were also byproducts of this operation. However, uses of algin at that time were still very limited so that soon after the war the kelp factories ceased operations and domestic algin production was suspended until 1926.

Stanford's original process has naturally undergone a series of improvements by a number of investigators. At the present time, there are two basic patented processes in commercial use in this country—Green's cold process used by the Kelco Co. in San Diego, Calif., and LeGloahec-Herter's process used by the Algin Corp. of America in Rockland, Me. Both of these processes have, of course, been modified to some extent by the present producers.

Producers of Seaweed Colloids and Related Products in the United States.[1]

Name of Firm	Location of Plant	Product	Seaweed Used
Agar Co. of California	Orange, Calif.	Agar	Gelidium
Agar Products Co.	Los Angeles, Calif.	Agar	Gelidium
Algin Corp. of America	Rockland, Me.	Algin	Laminaria
American Agar & Chemical Co.	San Diego, Calif.	Agar	Gelidium
W. H. & L. D. Betz Co.	Rockland, Me.	Algin paste	Laminaria
Dental Research Co.	St. Petersburg, Fla.	Kelp tablets	Macrocystis
Bowey, Inc.	Bath, Me.	Carrageenin	Chondrus
Feedwaters, Inc.	New York, N. Y.	Algin paste	Laminaria (imported)
Sperti, Inc.	Jensen, Fla.	Agar	Gracilaria
Kelco Co.	San Diego, Calif.	Algin Kelp meal	Macrocystis
Kraft Cheese Co.	Chicago, Ill.	Carrageenin	Chondrus
Krim-Ko Co.	Scituate, Mass.	Carrageenin Agar	Chondrus Gracilaria
Northwest Kelp Co., Inc.	Anacortes, Wash.	Kelp meal Kelp tablet	Nereocystis
Pacific Agar Co.	Whittier, Calif.	Agar	Gelidium
Philip R. Park, Inc.	San Pedro, Calif.	Kelp meal Kelp tablet	Macrocystis
Roselle Agar Gel Co.[2]	Jensen, Fla.	Agar gel	Gracilaria
Van Sant, Inc.	Beaufort, N. C.	Agar	Gracilaria
Walsh Kelp Laboratory	San Diego, Calif.	Kelp tablet	Macrocystis
Jacque Wolf & Co.	Passaic, N. J.	Carrageenin	Chondrus Gigartina (imported)

[1] Firms engaged only in harvesting and curing seaweeds not listed. [2] Production suspended in 1943. [3] Still in pilot-plant stage, expected to start production soon.

GREEN'S COLD PROCESS

The "cold" process of Green (Fig. 2b) as revealed in U. S. Patent 2,036,934, is characterized by the fact that it is largely conducted at the relatively low temperature of 50 deg. F. Freshly harvested kelp is placed in a leaching tank with cold water previously acidulated to 0.33 percent hydrochloric acid. The kelp is left in this acid leach water from one to several hours until the salt content is reduced to 5-15 percent. The liquid is then drained off and discarded.

Leached kelp is chopped into convenient sizes fed to a hammer mill shredder, and then placed in a digestion tank containing 40-50 lb. of soda ash in solution per ton of freshly harvested kelp. The pH is controlled at about 10; digestion is usually completed in 30 min. The kelp is further digested by a similar process for another half hour. The resulting pulp is again passed through a hammer mill shredder and six volumes of treated water added. The pH is maintained at 9.6 to 11. In cases where crude sodium alginate is satisfactory, the fibrous material is dried and sold as such. For most purposes, however, a highly purified product free from cellulose and other impurities is required.

For a pure product, the crude liquor is pumped into a clarification tank and a filter aid, such as diatomaceous earth, added. The supernatant liquor is filtered through an ordinary mechanical filter press. The temperature may now be temporarily raised to about 120 deg. F. to aid filtration. Other methods of clarification that can be used include centrifuging, vacuum filtering, sand filtering or settling of the cellulose material.

Filtered liquor is slowly added to a 10-11 percent calcium chloride solution under constant agitation. Calcium chloride is used in the proportions of about 100 lb. to 8 tons of the alginate liquor. When agitation stops, precipitated calcium alginate gradually rises to the top. The remaining liquor, containing water soluble salts and organic matter, is drained off.

More water is now added to the precipitate in the same tank and a bleaching agent such as sodium hypochlorite introduced. The amount of hypochlorite added depends on the color of the crude product; generally 1 percent is sufficient. Excessive bleaching will have an adverse effect on the final product.

PURE ACID FORMED

Bleached calcium alginate precipitate is separated from the water and introduced into a 5 percent hydrochloric acid solution. About 42 parts of the acid solution is used for each part of alginate. The acid converts the calcium alginate into fibrous alginic acid. The slurry is passed through a screen to remove excess acid and calcium chloride resulting from the chemical reaction. The drained alginic acid precipitate is introduced into a second tank of acidulated water, agitated, then pumped over another screen. This treatment is repeated until the precipitate is washed free of calcium salts. Enough treated water is used in each washing to raise the pH above 1.9 and simultaneously to reduce the amount of calcium in the product.

Purified alginic acid is filtered and stored in a refrigerated room or converted into the sodium or other salts by treating with the corresponding carbonate, oxide or hydroxide. The alginate thus formed is dried by standard methods, ground, screened and packaged or mixed with other ingredients to form one of several commercial products. The California concern makes at least six different kinds of alginate products, each for certain specific uses.

LE GLOAHEC-HERTER PROCESS

The LeGloahec-Herter process, as revealed in U. S. Patent 2,128,551, takes advantage of the fact that a dilute solution of alkaline earth salts such as calcium chloride will dissolve laminarin, mannitol and other salts in the kelp without any harmful effect on the algin.

Kelp used in this process (Fig. 2a) may be freshly harvested or air dried. To one volume of dried kelp, three volumes of 0.8-1.0 percent calcium chloride solution are added. Lixiviation may be carried out hot or cold, the latter being preferred. Leached kelp is then washed with softened water to remove the calcium chloride as well as the remainder of the laminarin, mannitol and other salts. Washing is stopped when the wash water contains about 0.5 percent soluble matter. The washed kelp may be subjected to an additional treatment with 5 percent hydrochloric acid to dissolve any residual alkaline earth salts. It is then washed with softened water before digestion.

To one volume of the well-lixiviated kelp, two volumes of 4 percent soda ash solution are added. Digestion may be performed in any suitable vessel, the mixing being helped by beaters such as those commonly used in pulp making. Maceration is continued until the cellulose is reduced to fine particles and a homogeneous paste obtained. This will take about 2 hr. at

104 deg. F. and about 3 hr. at room temperature.

The kelp paste is diluted with water in the ratio of 3:7. The mixture is beaten to a homogeneous suspension and air introduced through fine apertures to stir up the whole mass vigorously. It is claimed that oxygen in the air helps to make a product of high viscosity. If oxidizing agents such as ozone or hydrogen peroxide are introduced mechanical agitators are used. The liquor is then passed continuously at high speed through a centrifuge which charges it with air bubbles. The resulting emulsion is conveyed to a clarification tank where, after standing for 6-10 hr., the cellulose particles agglomerate to a compact floating cake. The clarified liquor can then be removed without difficulty.

COLOR ADSORBED

Clarified crude liquor, still colored by seaweed pigments, must be purified to yield a white product. An adsorbent jelly made of hydrated alumina, gelatinous silica and aluminum alginate is preferred, although other similar ones can be used. The jelly is added to the colored liquor in about 20-25 percent of the weight of dry alginous material. The mixture is stirred and the pigments soon adhere to the jelly. This can be removed by centrifuging and reclaimed by various methods, such as by washing with alcohol or other organic solvents.

The liquor is now clarified and freed from pigments and other impurities. Addition of a strong acid such as hydrochloric maintained at a pH of 2.8-3.2 will precipitate alginic acid. The mineral acid and the alginous liquor are introduced separately to meet in a mixing baffle, slightly inclined inside a tank. The precipitate flows at once to the adjoining tank, thus minimizing contact with fresh mineral acid, which tends to have an adverse effect on the final product. Carbon dioxide evolved from the reaction between soda ash and hydrochloric acid helps the precipitate of alginic-acid to float and thus overflow into the next tank.

This precipitate of alginic acid is placed in baskets and allowed to drain. Freed from the remaining liquor by pressing or centrifuging, it is comminuted and further purified by washing with solvents such as ethanol in a vessel provided with a filter plate. Purification of precipitated alginic acid by ordinary dialysis or by electrodialysis has been suggested.

Purified alginic acid, containing some adhering alcohol, is dried in a specially constructed oven at 150-170 deg. F. A method of purifying and drying the alginic acid in special rotating drums has been suggested. In both cases, the alcohol may be reclaimed. Alginic acid is converted into its sodium or other salts by the regular processes.

Methods for the recovery of laminarin and iodine are also patented (U. S. Patents 2,188,092 and 2,233,787). In another process (U. S. Patent 2,163,147) for improving the decolorization of the alginous material, formaldehyde, tannic acid or other protein coagulants are added to the soda-digested kelp. The proteinaceous material coagulates and adheres to the cellulose, while the seaweed pigments become fixed to this coagulated mass. Chlorophyll and other plant pigments may then be recovered if so desired. Some 22 lb. of commercial formaldehyde is added to 2.5 tons of water for each ton of demineralized kelp. The mixture is allowed to stand for about an hour. The treated kelp is then taken out and stored for 15-21 days, causing substantial fixation of the colored matter on the protein-cellulose mixture. When soda ash solution is added to the kelp, it dissolves only the alginous matter, which can thus be separated from both the cellulose and the pigments. The process from this point is the same as already described except that decolorization by alumina-silica-alginate jelly is omitted.

Thus the process used by the Algin Corp. of America differs from that of the Kelco Co., as revealed by their patents, in four main points: (1) Dilute calcium chloride solution is used in the leaching, (2) clarification is done by a special aeration and centrifuge system instead of by filter aids and filter presses, (3) precipitation of calcium alginate is omitted, and (4) to decolorize the product, either a pigment-adsorbent jelly or a protein coagulent is used.

WHERE ALGIN IS USED

Because of its unique and useful properties as a colloid, algin has been enjoying a steadily expanding market during the last decade. There is little doubt but that its properties as an emulsifying, suspending, gelling and bodying agent will lead to an increasing usage in industry.

Largest single present use of algin in the United States is as a stabilizer to impart smooth body and texture to ice cream and to prevent coarsening during storage due to the formation of large ice crystals. According to one estimate, more than 50 percent of the factory-made ice cream in this country is stabilized with a special alginous product under the trade name of Dariloid. Being nutritive and not an allergen, algin is used extensively in food industries in the preparation of cakes, jellies, icings, whipping cream and chocolate milk.

A very important use of algin is as a latex creaming agent in the manufacture of natural rubber. Ammonium alginate, regarded as the best substance for this purpose, is said to be used similarly in the processing of synthetic rubber. Both ammonium and sodium alginates are widely used as suspending and emulsifying agents in the manufacture of casein emulsion paints. For preventing the encrustation of boilers, sodium alginate is useful since it precipitates calcium salts present in the water. The precipitated calcium alginate forms globular flocculent masses and envelopes other sediments to give a soft pasty sludge which can be blown out of the boilers at regular intervals.

Use of algin in dental impression materials is a recent development as a result of the agar shortage, yet its merits for this purpose have been firmly established. There is no doubt that as a dental material, algin has already passed the agar-substitute stage and is here to stay. Another recent use of algin is to cover and protect dentures made of acrylic resin. Because of certain advantages over the tinfoil formerly used for this purpose, algin will undoubtedly become a standard dental coating material in the future.

MANY APPLICATIONS

Algin serves in various pharmaceutical and cosmetic preparations as an emulsifying, suspending, gelling and bodying agent. It has been used as a component of sulfanilimide and similar ointments. To some extent, algin has replaced tragacanth and other natural gums in the preparation of greaseless lubricating jellies. It is used as a vehicle for hand lotions of the saponified type and is a base for various creams and toothpastes.

As a sizing material algin is valuable, being superior to starch as it fills the cloth better, is tougher, more elastic and goes farther than starch or gum. As soon as the sodium alginate has impregnated the cloth it can easily be made insoluble, if so desired, by treatment with dilute acids, lime water or metallic salts. Ammoniated aluminum alginate can be used in the preparation of waterproof fabrics since it becomes insoluble after drying. Algin is quite extensively used as a thickener in printing pastes. In the form of triethanolamine alginate, it is used for coating solid surfaces. In recent years, great interest has been shown in utilizing alginate fibers as textiles, and specially treated algin fibers have already found uses because they are alkali-resistant and fireproof. Beryllium alginate fibers are employed in camouflage nettings.

Among the many uses of algin, dormant and active,* are the preparation of fire-retarding compounds, insecticide sprays, can-sealing compounds, oil well drilling mud, storage batteries, varnishes and the dressing of mildew-resistant canvas and burlap. It is used to a small extent in clarifying liquor, finishing leather, and in making color-adsorbing materials.

* An extensive discussion of the history, properties and uses is given by the author in the forthcoming Vol. VI of Jerome Alexander's "Colloid Chemistry" to be published this year by the Reinhold Publishing Corp. See also pp. 18-19 of Gregory's "Uses and Applications of Chemicals and Related Materials" (Reinhold Publishing Corp.) for a classification of algin uses.—Editor.

BUTYL ALCOHOL BY FERMENTATION OF WASTE SULPHITE LIQUOR

DEVELOPMENT of a process for the production of butyl alcohol by fermentation of waste sulphite liquor was announced in Seattle in mid-April by Dr. Bror L. Grondal, University of Washington professor of forestry, and Maj. Henry W. Berger, research chemist and fermentologist, formerly with the Bureau of Chemistry, United States Department of Agriculture.

The discovery, a result of two years of research, may open up vast new fields for the pulp industries which, for lack of practical use for the sulphite liquor, representing about 50 percent of every log used to produce chemical pulp, have been forced to dispose of it as waste. Not only would the process provide a means of utilizing almost 100 percent of the wood, but it would eliminate the source of a long and bitter battle between Northwest pulp interests and the fisheries, who charge that discarding such liquors into Puget Sound kills fish and oysters.

If given practical application, the process will provide a new source of butyl alcohol for the plastics and other industries. Waste sulphite liquor contains about 2 percent of fermentable sugar. From 100 lb. of this sugar, the process will produce about 22-23 lb. of butyl alcohol, 10-12 lb. of acetone, and about 3 lb. of ethyl alcohol. Explaining the findings, Major Berger stated that the key to the entire process probably hinges on being able to get rid of inhibiting materials and to retain the growth elements necessary for normal development of the Weissman bacillus or *Clostridium acetobutylicum*.

FORMER PRACTICE

Heretofore, it has been known that to produce butyl alcohol in quantity from sulphite liquor, the presence of certain growth factors, including biotin and another unidentified factor, perhaps a vitamin that is present in molasses, was necessary. In all previous attempts to produce the alcohol from this source, it was found necessary to add molasses in order to supply this growth factor. This made the process as expensive as using pure molasses. In the new process, however, yeast is produced without the introduction of molasses, thus making the production of butyl alcohol and acetone from sulphite liquor relatively inexpensive.

Also from the liquor will come a new type of fuel, extracted by adding certain chemicals to the liquor to produce "a very heavily insoluble fuel precipitate which must be removed as a part of the first step." This precipitate which, when dried, forms crystals about the size of a split pea and appears somewhat like coke, is rated as having about 6,000 B.t.u. per lb. as compared with about 5,000 to 8,000 B.t.u. in wood and about 12,000 B.t.u. in coal. Recovery of this substance from the liquor would comprise about 75 percent of the fuel used in the actual production of the pulp and the liquor at the pulp mill digesters. By weight it comprises about 12 percent of the total volume of liquor now being dumped into Puget Sound alone at the rate of about 1,600 tons daily. This would mean that a usable fuel is being discarded at the rate of 192 tons daily.

The new fuel, which burns like coal, gives off a sulphurous odor which may render it undesirable for domestic use. However, it can be used either in its original form for stokers, powdered for blowing into furnaces under air pressures, or pressed into lumps or logs.

In addition, the process would make available large quantities of yeast fodder for livestock. The yeast, high in nutritional value and vitamin content, is described as chemically pure and suitable for use in the home and by commercial bakers.

PROSPECTS FOR A WET-MILLING INDUSTRY IN WASHINGTON

PROSPECTS for a starch-sirup-dextrose sugar industry in Washington have been appraised by Dr. Joseph L. McCarthy, assistant professor of chemical engineering, University of Washington, and Dr. John A. Guthrie, associate professor of economics, State College of Washington. Their findings are reported in "Starch, Sirup, and Dextrose Sugar From Washington Wheat and Potatoes," Research Project 46, Washington State Planning Council, Olympia, Washington.

FINDINGS

1. That irregularly occurring surplus supplies of wheat or potatoes could not ordinarily be used as the sole or primary raw material for a Washington wet-milling industry.

2. That under normal postwar conditions, surplus as well as inferior grade or cull wheat or potatoes, if fed to livestock would provide a return to the farmer which would probably be equal to or greater than that which he would receive if his products were used in a Washington wet-milling industry.

3. That postwar prospects for the establishment of a successful potato wet-milling industry in Washington are not favorable; at present, there do not seem to be practical possibilities of changing those prospects.

4. That postwar prospects for the establishment of a successful wheat wet-milling industry in Washington are fair; there are approximately equal chances for and against its success.

RECOMMENDATIONS

1. That interest be maintained in the important research on the processing of wheat and wheat byproducts which is being conducted in the Northern and Western Regional Research Laboratories of the United States Department of Agriculture.

2. That research be undertaken with the objective of developing or improving methods for production of widely useful modified wheat starches from wheat starch.

3. That research be undertaken with the objective of acquiring additional scientific information concerning wheat gluten, wheat oil, and other byproducts of wheat starch manufacture and also of developing or improving methods for production of widely useful products from these materials.

A Washington wheat wet-milling industry would find it necessary to develop remunerative outlets for all its byproducts including wheat protein and wheat oil products. In the early stages of development, probably all of the byproducts would be sold as animal feeds. More remunerative outlets for wheat gluten and wheat oils would be found as a result of future research. On the whole, byproduct credit from a Washington wheat wet-milling industry would probably not exceed that obtained from byproducts of the corn wet-milling industry.

If, in the future, soft wheat in Washington should continue to be available at a price as low as that of corn in the Corn Belt, and if the credits from the sale of byproducts from wheat were about the same as those obtained from corn, then the significant factor in determining the feasibility of establishing a wheat wet-milling industry in Washington would be the relationship between the saving in Midwest plants due to mass production and the transportation advantage of a Washington industry.

A Washington wheat wet-milling industry would probably have a transportation advantage in local markets (Seattle, Spokane, Portland, etc.).

PAUL BEAL PETTY *Hydrocarbon Research, Inc., New York*

METALS

For Service at Subzero Temperatures

High temperatures are an old story in the process industries, and the chemical engineer has experience and data aplenty to fall back on in selecting materials of construction for such service. But when the thermometer goes the other way and drops two or three hundred degrees below zero, the problem of specifying materials finds the average designer on uncertain ground. It is not out of order, therefore, to examine the subzero behavior of some common metals and alloys —and happily, there are several which qualify as structural materials for low-temperature processes.—*Editors*

Typical low temperatures encountered in various process industries

—40 deg. F.	**Refrigeration**
—40 deg. F.	**Propane dewaxing in petroleum refining**
—80 deg. F.	**Sulphur dioxide dewaxing in petroleum refining**
—150 deg. F.	**Butyl rubber production**
—250 deg. F.	**Liquefaction and storage of natural gas**
—315 deg. F.	**Liquid air installation**
—323 deg. F.	**Helium extraction**

AUTHORITIES are in general agreement that most physical characteristics of metals improve at subzero temperatures. Increases are registered in tensile strength, yield point, fatigue strength, and hardness. Contraction continues as the temperature sinks below zero, but at a slightly reduced rate. Metals return to room temperature unchanged.

However, there is one characteristic of metals which usually depreciates at low temperatures. That is their ability to withstand impact. This property becomes crucial in subzero applications, and is frequently the determining factor in choosing one metal or another. The quality which changes is termed "notch-brittleness." While it may be possible to design without notches, even the most optimistic designer would prefer a material which is notch-tough. Furthermore, even if notches are eliminated, impact tests are still valuable in that they afford a means of evaluating a metal's reaction to the three-dimensional stresses which are present in practically all structures. It is for this reason that impact tests are widely accepted for determining the material to be used for subzero temperatures.

IMPACT TESTING

Two common types of impact test are in use today, the Izod and the Charpy. The two are alike in principle but differ in details. In each test the specimen is a "standard" notched bar, 10 mm. (0.394 in.) on a side and about 2 in. long. The bar is fixed rigidly in a machine and struck a single heavy blow by a swinging, pendulum-like hammer. At the start of its swing, the pendulum has a certain amount of potential energy which is proportional to its weight and to its height above the test bar. A portion of this energy is lost in breaking the bar, so that the pendulum, at the end of its swing, does not rise to its initial height. The difference in height is a meaure of the energy required to break the bar, and this value in ft. lb. is used as a determination of the material's notch-brittleness.

The major differences in the two tests lie in the shape of the notch and the positioning of the bar in the testing machine. The Izod notch is V-shaped, and in the Izod machine the bar is clamped in a vise at one end and struck at the other. The Charpy notch is keyhole-shaped, and in the Charpy machine the bar, resting on a split anvil, is supported at both ends and struck in the middle. There are occasions when it is desirable to test an Izod-notched bar in a Charpy machine, and it is not unusual to find this combination of the two procedures.

There is one very important feature of impact testing which must never be lost sight of when evaluating data and comparing materials. The values obtained are extremely sensitive to variations in test procedure. Therefore, the various metals for which data are given here may be compared on the basis of differences in shape of curve (i.e., differences in the effect of low temperature on room-temperature properties), but they cannot be compared on the basis of differences in absolute impact values, since the "ft. lb." required to break a specimen is as much a function of the test procedure as of the metal's properties.

ALUMINUM

For all practical purposes the physical properties of aluminum at subzero temperatures remain unchanged or actually improve. This is shown conclusively by data in Circular C-447, "Mechanical Properties of Metals and Alloys" of the National Bureau of Standards.

When J. J. Kanter of the Crane Co. checked the data given here he got lower values, but the same trend—which emphasizes two facts brought out in Project No. 13 of the ASME-ASTM Report, "Impact Resistance and Tensile Properties of Metals at Subatmospheric Temperatures." The Report states, first, that different heats at the same alloy may show different impact values, and second, that impact values should be studied through the temperature range which is under consideration without regard to numerical

values. Thus, in the case of aluminum, if values are good enough at room temperature, it is reasonable to predict that they will be satisfactory at —300 deg. F.*

NICKEL AND STAINLESS STEEL

Commercially pure nickel shows higher impact at subzero temperatures than at room temperature. Its value at —300, however, drops off. This is shown in the figure below, along with the trend for Monel and Inconel.

The importance of nickel in steel for low-temperature application is generally accepted, especially if the steel cannot be used in the fully heat treated condition. Recent investigations indicate that the trend in impact value improvement is proportional more or less to the amount of nickel up to 40 or 45 percent, at which point the condition becomes stabilized for —310 service. This trend has been known since P. Chevenard's experiments on iron-nickel alloys, published by International Nickel Co. in their bulletin, "Properties of Nickel Alloy Steels at Low Temperature." The impact values for other percentages of nickel and iron have been on record for some time to confirm Chevenard's report.

Nickel increases the physical properties of iron as the temperature decreases. Ductility is improved as the percentage of nickel is increased. It is principally for this reason that nickel additions are made for low-temperature application. Deoxidized steels of 3½ and 5 percent nickel fall short of the —300 mark, but they may be considered for service at —150 and —260.

Indications are that most austenitic steels are satisfactory as low as —300. This is due in certain cases to the fact that impact values in general are high. Chromium in austenitic steels does not have marked beneficial effects unless it is essential to keep the alloy truly austenitic.

Anyone considering the use of stainless steels for extremely low temperatures can be assured by the fact that these steels have been in service for a number of years in the form of pressure vessels for handling helium. That would be for temperatures below —300. Furthermore, before it was realized that a danger existed, these vessels were made of a 2½- to 3½-percent nickel steel and were in operation for many months before they were replaced by higher alloyed steels.

COPPER

All physical properties of copper and its alloys are retained or improved at subzero temperatures. Commercially pure copper can be recommended for temperatures down to at least —300. Improvement in all mechanical properties has been demonstrated by tests on 99.96-percent copper conducted by A. Pomp and co-workers and reported in the ASME-ASTM Project.

Kanter measured impact values of brass, aluminum bronze, silicon bronze, and manganese bronze at 80, —100, and —300, and found no appreciable change from room temperature.

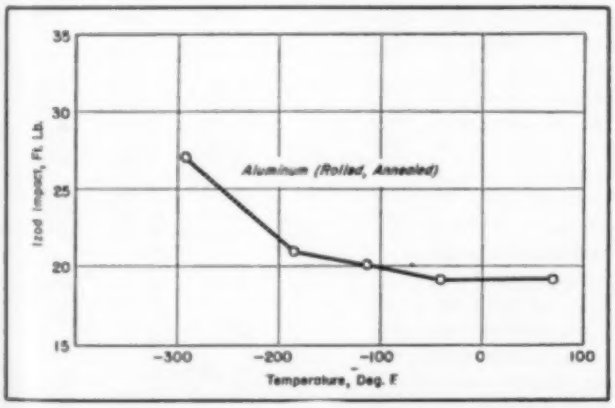
LEAD

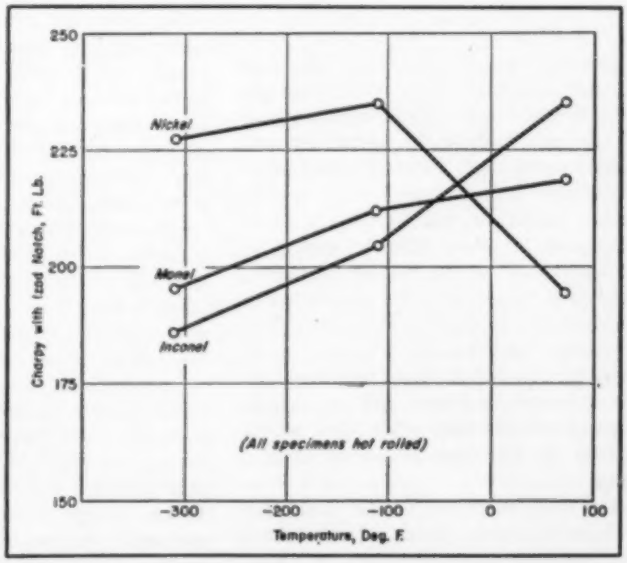
Commercially pure lead has satisfactory physical properties for —300 service. All mechanical properties improve in a manner similar to commercially pure copper. But unlike copper and its alloys, certain lead alloys do not retain their room-temperature impact resistance at subzero temperatures.

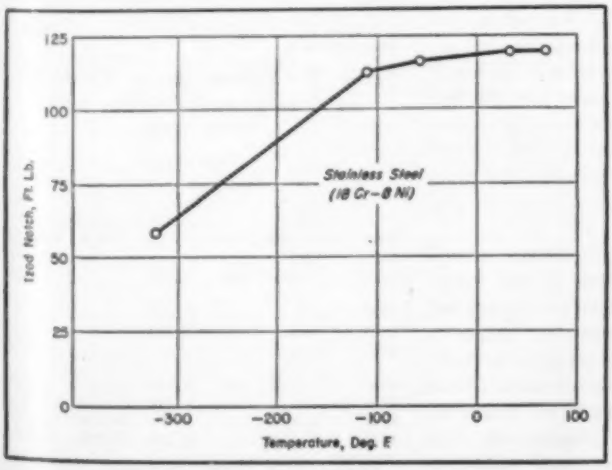
Particular attention is being given to this problem in a plant operating at —300 at this time. Copper piping is used with 50-50 soldered socket joints. These have failed on numerous occasions. Their failure can be attributed, in part at least, to notch brittleness and loss of ductility, which was suspected on the basis of data published in the Bureau of Standards Circular C-447. These show satisfactory impact values for commercially pure lead, but unsatisfactory values for lead solder, at subzero as compared to room temperature.

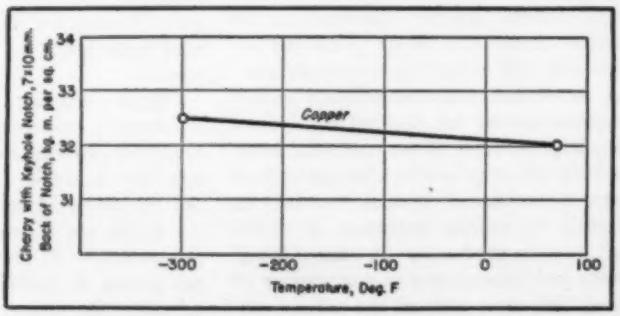
* Temperatures throughout this article will be in terms of deg. F.

Effect of subzero temperatures on room-temperature "notch-brittleness" of various metals









GEORGE D. BIEBER *Chemical Economist, Tar and Chemical Division, Koppers Co., Pittsburgh, Pa.*

CHEMICALS

For Phenolic and Urea Resins

Rapid expansion in domestic production of synthetic resins has been accompanied by a rise of similar proportions in the demand for component chemicals with this use accounting for a major part of our phenol and formaldehyde production. It is estimated that for each pound of phenolic and urea condensation product manufactured, there is a market for 1.7 to 1.8 pounds of chemicals.—*Editors*

PHENOLIC RESINS sometimes called tar-acid resins, were first made commercially in the United States approximately 35 years ago. Only limited quantities were manufactured until about 10 years later. They were derived largely from natural phenol. Production was restricted not only because of the small domestic output of natural phenol but also because the moderately large world supply was controlled principally by England and Germany. This situation caused numerous research workers to give special attention to the properties of xylenols and meta and para cresols. These chemicals have since been widely utilized in the manufacture of tar-acid resins.

The large expansion in the production of byproduct coke during World War I was partially responsible for the subsequent growth in the manufacture of phenolic resins. The output of natural tar-acids was not initially increased appreciably by the large-scale introduction of this improved process for making coke. However, large amounts of benzene were made available which permitted the synthesis of huge quantities of phenol, needed so urgently for military explosives. By 1918 the annual production in the United States had risen from a prewar average of about 500 short tons of the natural material to 53,500 short tons, largely of synthetic origin.

A large percentage of the stocks of phenol, estimated at 17,500 to 20,000 short tons, on hand at the close of the war was consumed in the form of phenolic resins by the rapidly expanding automobile and radio industries sooner than was anticipated. Moreover, requirements became of such magnitude that the synthetic manufacture of phenol, which had been abandoned as too costly soon after hostilities ceased, was undertaken by several manufacturers in 1922-23. Synthetic phenol has since accounted for about 70-80 percent of the annual domestic production (Table I) and has been the most important aromatic material used in the manufacture of phenolic resins.

The byproduct coking industry also has made available appreciable quantities of cresols, cresylic acid, and xylenols which are utilized in the manufacture of synthetic resins, particularly for the laminating and coating fields. Domestic production of these acids, a large percentage of which is derived from coal, is shown in Table II.

Urea-formaldehyde resins were prepared as early as 1896. These condensation products had a poor water-resistance and developed fissures and cracks. A synthetic resin containing thiourea was developed in England in 1926, but it met with only limited success. The strength and water-resistance were greater than the urea resins made at this time but the cost of production was higher. Furthermore, the sulphur attacked the molds and decreased the rate of cure. Three years later the first successful urea-formaldehyde molding compositions were marketed in the United States. During the past decade, other types have been developed for a variety of purposes.

Official statistics concerning annual consumption of chemicals in the manufacture of phenolic and urea-resins are not generally available. However, estimates can be calculated from production statistics by the use of conversion factors. Since the quantities of raw materials consumed per pound of finished product vary considerably, the figures presented in this review are only rough approximations. Nevertheless, they are useful in measuring the increasing demand for chemicals for the manufacture of phenolic and urea resins.

While data presented in this report are based primarily upon production statistics published annually by the U. S. Tariff Commission, some figures are calculations from production data estimated by the writer. Conversion factors were obtained

Table I—Estimated United States Production of Natural and Synthetic Phenol, 1918–1942

Short Tons

Year	Natural	Synthetic	Total
1918	3,500*	50,000*	53,500
1919	300*	500*	800
1920	.....	None	.....
1921	.....	None	.....
1922	700*	None	700
1923	900	800	1,700
1924	.....	.....	.....
1925	1,800	5,600	7,400
1926	1,000	3,300	4,300
1927	1,000	3,000	4,000
1928	1,000	4,100	5,100
1929	2,300	9,800	12,100
1930	3,200	7,400	10,600
1933	5,000	11,600	16,600
1934	6,800	15,700	22,500
1935	6,500	15,200	21,700
1936	7,300	17,100	24,400
1937	11,700	21,100	32,800
1938	6,700	15,600	22,300
1939	10,300	24,000	34,300
1940	12,000*	36,100*	48,100
1941	12,500	45,000	57,500
1942	14,000†	61,000†	75,000

* Data from U. S. Tariff Commission. † *Chem. & Met.* estimate.

Table II—United States Production of Cresols and Cresylic Acid, 1933–1943

Short Tons

	Cresols			Cresylic Acid	
Year	Meta and Para	Ortho	Ortho, Meta and Para	Crude	Refined
1933	.....	....	.....	.....	6,900
1934	1,000	400	4,500	.....	5,500
1937	.....	....	6,900	.....	.....
1938	.....	....	5,700	.....	.....
1939	.....	....	.....	.....	.....
1940	.....	700	8,000	.....	9,200
1941	.....	....	8,500	.....	13,300
1942	3,500	....	5,400	10,200	18,000
1943	4,400	....	4,200	12,600	19,600

Source: U. S. Tariff Commission.

from *Chem. & Met.*'s "Chemical Engineering Flow Sheets" and from other sources.

The markets for chemicals considered in this study are limited to the years from 1933 to 1943, inclusive. Raw materials utilized for special purposes as well as those consumed in small amounts are excluded. Additional chemicals such as pigments and solvents required to make commercial products from phenolic and urea resins are also deleted.

PHENOLIC RESINS

Phenolic resins are generally produced by condensing (1) phenol, (2) phenols and cresols, (3) cresols and cresylic acid, (4) cresols and xylenols, and (5) xylenols with formaldehyde and related materials. Table III shows that synthetic resins derived from phenol represented about 66 percent of the 499,000 short tons manufactured during the period 1933-1943, inclusive.

Table III—Estimated Production of Tar-Acid Resins, 1933-1943*

	Total Short Tons	Relative Percent
Phenol	328,200	65.8
Phenol and cresols	88,100	17.6
Cresols and cresylic acid	49,700	9.9
Xylenol and cresol resins	26,500	5.3
Xylenol resins	6,800	1.4
	499,300	100.0

* Based upon production statistics published by U. S. Tariff Commission and upon data estimated by the writer.

An indication of the versatility of phenolic resins is shown by Table IV which presents the relative output of resins derived from phenol in 1943. While cresols, cresylic acid, and xylenols are also utilized for a number of these types, they are used largely in the manufacture of resins for coating and laminating purposes.

Table V reveals that tar-acids, formaldehyde, fillers, and hexamethylenetetramine are required in the manufacture of phenolic resins. About 33,000 short tons of these raw materials were required in 1933. Consumption of these chemicals increased to approximately 69,000 short tons in 1937. By 1943 the total had risen to 138,400 short tons, or about twice the 1937 figure. Although the figure varies according to the relative output of each type of product manufactured, an average of 1.7 pounds of raw materials were utilized for each pound of condensation product manufactured.

Urea resins are manufactured by reacting urea with formaldehyde under certain conditions. These resins find numerous industrial applications. The adhesive industry is the most important consumer at the present time. About 60 percent of the total production was utilized for this purpose in 1943; 9 percent for protective coatings, and 31 percent for molding compositions and miscellaneous uses.

Table IV—Relative Output of Synthetic Resins Derived from Phenol, 1943*

Type	Percent
Molding	49.3
Laminating	18.6
Protective Coatings	12.5
Adhesives	8.2
Casting	2.2
Miscellaneous	9.2
	100.0

* Based on preliminary statistics of U. S. Tariff Commission.

Table VI shows that urea, formaldehyde, cellulose fillers, and curing agents are important chemicals used in the manufacture of these resins. Consumption of these raw materials totaled 3,000 short tons in 1933. The quantities used increased rapidly since that year, exceeding 19,000 short tons in 1940. The figure reached 44,700 short tons in 1943.

Approximately 1.8 pounds of chemicals are required per pound of condensation product manufactured. It is interesting to note that identical quantities of urea and formaldehyde are required in the production of an average type of urea resin. Furthermore, appreciably larger amounts of formaldehyde are used per unit quantity of urea resins manufactured than in the production of the same amount of phenolic resins.

TOTAL CONSUMPTION

Total quantities of chemicals consumed annually in the manufacture of phenolic and urea resins rose steadily, except for minor recessions in 1938 and 1942, from approximately 36,000 short tons in 1933 to the record of about 183,000 short tons in 1943. More than 1,000,000 short tons of raw materials were consumed during the period reviewed. About 83 percent of this total was used in the production of phenolic resins, and the remainder in the manufacture of urea resins.

Table V—Estimated Consumption of Chemicals in the Manufacture of Phenolic Resins, 1933–1943

	Short Tons					
Year	Phenol	Cresols, Cresylic Acid and Xylenols	Formaldehyde (100% Basis)	Fillers	Hexamethylene-tetramine	Total
1933	12,500	4,300	7,800	7,800	700	33,100
1934	15,500	6,300	10,200	10,200	1,000	43,200
1935	18,300	7,700	12,200	12,200	1,200	51,600
1936	21,000	9,300	15,700	15,700	1,400	63,100
1937	26,600	8,200	16,200	16,200	1,500	68,700
1938	17,900	5,000	10,700	10,700	1,000	45,300
1939	27,700	8,400	16,800	16,800	1,600	71,300
1940	31,300	11,200	19,800	19,800	1,800	83,900
1941	51,100	13,600	30,000	30,000	2,800	127,500
1942	45,600	14,400	28,000	28,000	2,600	118,600
1943	56,900	13,300	32,600	32,600	3,000	138,400
	324,400	101,700	200,000	200,000	18,600	844,700

Table VI—Estimated Consumption of Chemicals in the Production of Urea Resins, 1933–1943

	Short Tons				
Year	Urea	Formaldehyde (100% Basis)	Cellulose Fillers	Curing Agents	Total
1933	1,200	1,200	600	.....	3,000
1934	1,200	1,200	700	.....	3,100
1935	1,500	1,500	800	(a)	3,800
1936	1,800	1,800	1,000	100	4,700
1937	3,200	3,200	1,800	100	8,300
1938	3,000	3,000	1,600	100	7,700
1939	6,000	6,000	3,300	200	15,500
1940	7,800	7,800	3,600	200	19,400
1941	12,500	12,500	4,600	300	29,900
1942	13,500	13,500	4,400	300	31,700
1943	19,400	19,400	5,400	500	44,700
	71,100	71,100	27,800	1,800	171,800

SUMMARY

The phenomenal growth in production of phenolic and urea resins has generated a large demand for chemicals. Approximately 33,000 short tons of phenol, cresols, cresylic acid, xylenols, formaldehyde, fillers and hexamethylenetetramine were consumed in the manufacture of phenolic resins in 1933 while 3,000 short tons of urea, formaldehyde, fillers and curing agents were required in the production of urea resins in the same year. About 138,000 short tons of raw materials were required for phenolic resins and 45,000 short tons for urea resins in 1943. These figures represent a 318 percent increase for phenolic resins and a 1,390 percent gain for urea resins. About 83 percent of the 1,016,000 short tons of chemicals consumed from 1933 to 1943 was used in the manufacture of tar-acid resins, while the remainder was consumed in production of urea resins.

* Raynolds, J. W., "Inter-Relationship of Plastics and Chemicals," *Chem. & Met.*, March 1944, p. 112.

EDWARD SIMONS *Consulting Engineer, San Francisco, Calif.*

Capacity Control for Atmospheric COOLING TOWERS

Although wartime operation generally demands the maximum capacity from water cooling towers, the author points out that some such towers are working at less than capacity owing to structural deterioration or the development of excessive organic growths. The article gives new simplified means of analyzing atmospheric towers and shows how the effect of improvements may be calculated. It also discusses the problem of organic growth control.—*Editors*

During the present war period, heat loads on many cooling towers have been increased. Yet, due to structural deterioration or lack of effective control of the algae and other organisms in the system, the present capacity of a given tower may actually be less than that during the initial operation. The purpose of this article is to provide a rapid means of analysis for atmospheric cooling towers, and to suggest methods whereby capacity can be controlled and increased.

A general description of conventional atmospheric water-cooling towers and a method of empirical analysis of such towers has been given in previous publications.[1, 2] The heated water is distributed at the top of the tower. In the splash-deck type which was illustrated on page 145 of Ref. 1, drop surface is formed as the water falls and splashes; sheet surface is formed as the flow passes over the guiding surfaces of the deck slats, slat supports, posts, braces and louvers. In examining the flow over a tower, one should note that the water covers the under surfaces of slats and structural members provided the distribution is adequate and the surfaces are continuous, level, and free from disturbing thallophytic growths.

In Fig. 1 an analogy is presented between heat balance in a cooling tower and weight balance in a scale. If the water rate or the water temperature are varied, balance must be restored by adjustment of the balancing factors shown on the left-hand side of the scale.

BALANCING FACTORS

Of these factors the driving force is a function of the difference between the temperature of the water and the wet-bulb temperature of the air in contact with the water. Now, the wet-bulb temperature of the air increases as heat is added to the air.[3] Thus, as air quantity is decreased for a given heat removal, the final wet-bulb temperature of the air is increased, although the wet-bulb temperature of the air entering the tower is constant.

The surfaces of the moving water films of the cooling tower are considered insulated with a thin film of stagnant, saturated air.[4a, 5] An increase in the second factor, air velocity, reduces the film thickness by a dynamic, peeling action. Thus, as in the case of any insulation problem, the reduced thickness of insulation permits greater heat flow; and increased air velocity over the cooling surfaces is associated with a greater rate of heat exchange. Of course, the increased air velocity through a given atmospheric cooling tower results in an increased air quantity passing through, with a consequent lowering of the out-going wet-bulb reflected in an increased driving force.

Rate of heat exchange in a cooling tower varies directly with the third factor, the extent of the surface of the water film.[2, 6] For a constant construction pattern and loading F, the surface increases in direct proportion to the ratio of increase in the number of decks. When F is decreased, the water does not cover the surfaces as

NOMENCLATURE

- A Surface efficiency factor employed in (Ref. 1).
- B Surface efficiency factor (Ref. 1).
- C_1 Reading on C Scale in Fig. 2 corresponding to T_1, decks.
- C_2 Reading on C Scale in Fig. 2 corresponding to T_2, decks.
- C $C_2 - C_1$, decks.
- C_i Value of C before alteration, Example (3)
- C_f Value of C after alteration, Example (3).
- D Dynamic surface factor, sq. ft. per g.p.m. and fall of H (Ref. 1).
- F Loading, g.p.m. per sq. ft. of active area $= Q/LW$ (Ref. 1).
- G Accelerated air velocity through tower, ft. per min. (Ref. 1).
- H Vertical distance, center to center, of splash decks, inches.
- J Angle which louver panel makes with the horizontal, degrees.
- K Heat transfer coefficient, B.t.u. per min., sq. ft., and in. Hg vapor pressure difference.
- L Active length of tower, center to center of end posts, feet.
- M Number of typical bays in length L.
- m Factor determined from Fig. 4, sq. ft. per g.p.m. and deck.
- N Number of splash decks in tower.
- Q Rate of water flow on to tower, U. S. gal. per min.
- r Factor determined from Fig. 3, sq. ft. per g.p.m. and deck.
- S Effective fixed sheet (wetted surface) area, sq. ft. per sq. ft. of active area (Ref. 1).
- T_1 Temperature of cooled water off tower, deg. F.
- T_2 Temperature of heated water on to tower, deg. F.
- V Wind velocity factor based upon velocity of approach of broadside wind.
- W Active width of tower, feet.
- W_H A width of tower corresponding to H, feet.
- X Increment control dosage of water treatment used.
- X_p Total control dosage in period Y = summation of X during Y.
- Y Period of time during which X_p is applied in increments of X.

completely as it does at a higher rate.[3] When the distance between decks H is decreased, the dynamic surface effect is decreased.

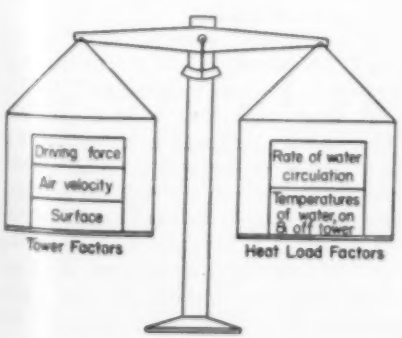
Consideration of Fig. 1 should now indicate, for example, that: (1) With constant water temperature, the effect of an increased water quantity must be balanced, at constant wind and wet-bulb, by an increase in tower size or surface; (2) with constant water temperature range, wind, wet-bulb, tower volume, and surface, the effect of an increased water quantity must be balanced by a rise of the water temperature range in the thermometric scale in order that the driving force may be increased to establish balance.

TOWER PSYCHROMETRICS

When the size of a tower is increased in the direction of width only (i.e., parallel to the wind), the air flow is not increased. Thus with F constant, an increased width will be accompanied by an increased water quantity over the tower. Suppose, for example, that the wind velocity through a tower were 350 ft. per min., but that the width were infinite. Obviously, the air would reach an equilibrium temperature equal to that of the water. Now consider the same wind velocity across a tower 6 ft. wide with F at 1.0 gal. per min. per sq.ft. of active area. For each foot of tower length and each deck a volume of air equal to $350(H/12)$ cu.ft. per min. would pass against the flow of 6.0 gal. per min. If the tower width were increased to 12 ft., then 12.0 gal. per min. per deck would encounter the same volume of air at the same velocity through the tower. Since the volume of air for each pound of water would be less in the case of the wider tower, the average driving force would be less due to an increased wet-bulb. The effectiveness of a unit area of each deck would thus be reduced. In other words, doubling the width of a tower with the deck spacing and the number of decks held constant does not double the heat removal capacity of the tower, as might be expected.

At very low wind velocities, the heat exchange is controlled by free convection.

Fig. 1—Balance of conditions within a cooling tower



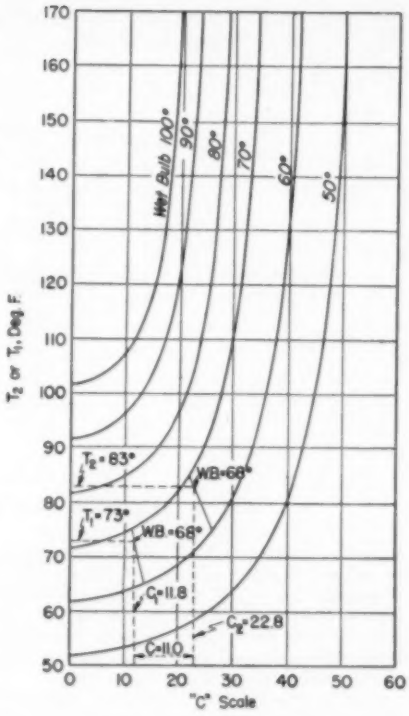


Fig. 2—Cooling chart for air flow at right angles to water flow and a 30-in. Hg. barometer

The coefficients of heat exchange for free convection from surfaces into air are functions of a large number of variables.[4b] However, for air at atmospheric pressure, the transfer coefficients for natural convection may be correlated by means of two variables: (1) The mean temperature difference, and (2) a dimension characteristic of the shape and orientation of the heat-transfer surface. Thus, the coefficients for horizontal plates facing upward differ from those for horizontal plates facing downward or from those for vertical plates.

Within an atmospheric cooling tower, some air movement is generated by the action of the falling water. In general, the factors in the accompanying tabulation may be used in practical computations for design or capacity study. When the wind direction is parallel to the length of the tower, the factor for zero wind should be used.

CALCULATING A TOWER

Fig. 2 presents a set of cooling curves, computed by stepwise integration for the condition of air flow at right angles to the water flow in a cooling tower of the splash-deck type. In using the curves, one locates the C_2 value corresponding to the temperature T_2 of the heated water on to the tower; and also the C_1 value corresponding to the temperature T_1 of the cooled water as it leaves the tower. Then,

$$C = C_2 - C_1 \qquad (1)$$

The number of decks may be computed from the formula:

$$N = \frac{25CV\,(W/W_H)^{0.4}}{BK\,[(AS/F) + D]} \qquad (2)$$

In Equation (2),

$$K = 3.00 + 0.0132G \qquad (3)$$

Values of A, B, and D and the method of computing S are given in Ref. 1; in the text of that reference, W is equivalent to the W_H of this article.

Figs. 3 and 4 are alignment charts for evaluating r and m respectively in a simplified formula which is here used in place of Equation (2). In the derivation of this formula K is assumed at 7.6, an average value for a louver inclination angle J of 55 deg.; and S is assumed at 2.7, a reasonable practical value. The simplified formula is then,

$$N = rCV/m \qquad (4)$$

Use of the alignment charts of this article in conjunction with Equation (4) permits very rapid calculation of tower characteristics. In the earlier design method[1] each tower width was restricted to use with a single deck spacing. In the method of the present article, a tower may be designed or calculated for any values of H and W that may be connected by a straight line on the nomograph of Fig. 3.

In some cases of design or tower selection, it may be advisable to use lower towers with closely spaced decks. Where considerations of leeward wind pressure enter into the calculation of tower supports, a lower tower will have a lesser leeward wind reaction than will a higher tower, since the vertical wind reaction of compression varies as the square of the height for a given intensity of pressure of the wind.

EFFECTS OF HEIGHT

On the other hand, when a lower tower is used, more decks are required than in the case of a higher tower. Thus, the dead weight of the lower tower per foot of height is greater than the dead weight per foot of height for the higher tower with wider deck spacing. Where foundations present a problem, several estimating solutions may be made to determine the height and deck spacing for a minimum weight condition at a given thermal duty of the tower.

Again, capacity of a given tower can be increased by addition of intermediate decks. In this case, the air supply is not increased, since the tower volume is un-

Values for Factor V for Various Broadside Winds of Approach

Wind, Mi. per Hr.	Factor V
5	1.00
4	1.10
3	1.25
2	1.45
1	1.70
0	2.10

changed. Furthermore, the reduced distance for falling and splashing results in a reduced dynamic surface effect per deck. Therefore, doubling of the decks does not double the tower heat removal capacity.

Inspection of Equation (4) will now indicate that C is the number of decks in the tower when the wind is 5 mi. per hr. broadside to the tower, and the ratio r/m is 1.00. The ratio of r/m is 1.00, for instance, when $F = 1.5$, $W = 10$ and $H = 29$. An increase in the value of C is accompanied by an increase in the air flow through the tower, since the curves of Fig. 2 have been computed by adding the effects of a great number of step-integrated towers of small height applied to the system as additions in the vertical direction of dimension. For barometric pressures other than the 30 in. Hg to which Fig. 2 applies, the number of decks will vary inversely as the square root of the barometric pressures. Thus, for a barometric pressure of 24 in. Hg, the number of decks computed from Equation (4) should be multiplied by $(30/24)^{0.5}$ or 1.12. Several examples will be solved to indicate the methods of computation.

Example 1—Design a cooling tower to cool 1,800 gal. per min. from a temperature of 83.0 deg. F. to a temperature of 73.0 deg. F. The wet-bulb temperature is 68.0 deg. F.; the wind velocity broadside is 4 mi. per hr.; the active width is 10 ft.; the active length is 100 ft.; the deck spacing is 12 in. center to center vertically; and barometer, 30 in. Hg.

Since the wet-bulb specified is not covered by one of the curves of Fig. 2, an interpolation is necessary. T_2 is removed from the wet-bulb temperature by an approach of (83 − 68) or 15 deg. F. An equal approach for a wet-bulb of 60 deg. F. indicates a temperature of (60 + 15) or 75 deg. F. Likewise, the value for 70 deg. F. wet-bulb is computed at 85 deg. F. A line is drawn on Fig. 2 joining 85 deg. on the 70 deg. wet-bulb curve with 75 deg. on the 60 deg. wet-bulb curve. C_2 is located on this line of equal approaches at a value of 22.8 decks where the temperature line of 83 deg. makes intersection. C_1 is located in a similar manner at a value of 11.8 decks; C then equals 11.0 decks.

From the table, $V = 1.10$. On Fig. 3, a line drawn from the H scale at 12 in. to the W scale at 10 ft. intersects the reference line at a point which is joined with the F scale by a line passing through a value of F of $1{,}800/(10 \times 100)$, or 1.8 gal. per min. per sq.ft. The intersection on the r scale is 4.27.

On Fig. 4, an F of 1.8 is joined with an H of 12 to give m equal to 2.20. Then, from Equation (4), $N = 4.27 \times 11.0 \times 1.10/2.20 = 23.5$ decks.

Example 2—What would be the number of decks for Example (1) if the deck spacing were 24 in. instead of 12 in.? In this case, r is 3.50 and m is 2.67. C and V are unchanged. Then, from Equation (4), $N = 3.50 \times 1.10 \times 1.10/2.67 = 15.9$ decks. The height of the tower for Example (2) is greater than the height of the tower for Example (1).

Example 3—A tower is 12 ft. wide with decks spaced at 30 in. center to center; the flow F is 1.5 gal. per min. per sq.ft. If the number of decks is doubled by adding intermediate decks at 15 in. centers, what will be the relative increase in the size of the tower? From Equation (4) $CV = Nm/r$. For the original tower conditions, $m = 3.17$ and $r = 3.30$. Then, $C_1V = 3.17N/3.30 = 0.96\ N$. When the intermediate decks have been added, their number will be 2N. However, $m = 2.60$ and $r = 4.00$. Therefore, $C_2V = 2N \times 2.60/4.00 = 1.30N$. Then $C_2V/C_1V = 1.30N/0.96N = 1.35$. Thus, a doubling of the number of decks with the same total volume of the tower results in an effective size increase of only 35 percent.

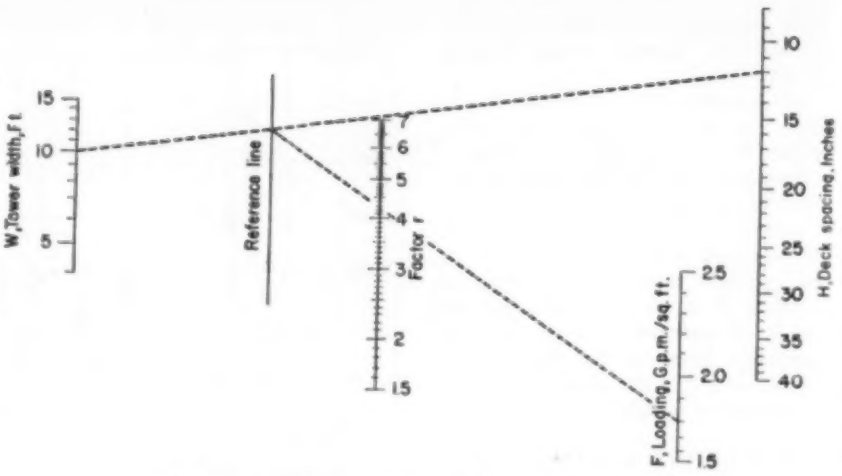


Fig. 3—Alignment chart for evaluating r in Eq. (4)

Example 4—A tower 12 ft. wide with 10 decks at 36 in. centers was originally loaded uniformly at $F = 1.30$ gal. per min. per sq.ft. However, due to structural deficiency, the decks have sagged so that the water is spread over only two-thirds of the length of each section. At a wind of 3 mi. per hr. broadside, a cooling range of 10 deg. F., and a wet-bulb of 70 deg. F., what will be the approach to the wet-bulb with the sagging decks, and what will be the approach to the wet-bulb when the sag is corrected to achieve uniform distribution?

Here, since the continuous distribution has been impaired, the complete volume of the tower is not active; the resulting operating effect is that of a number of individual towers 12 ft. wide with a loading of $F = 1.30/0.667 = 1.95$ gal. per min. per sq.ft. From the alignment charts, Figs. 3 and 4, $r = 3.43$ and $m = 2.95$ when $F = 1.95$. The table gives $V = 1.25$. Rewriting Equation (4) as $C = Nm/Vr$, then $C = (10 \times 2.95)/(1.25 \times 3.43) = 6.88$. The length of a 10 deg. interval on the temperature scale of Fig. 2 is laid off on the straight edge of a piece of paper; the length of a C scale intercept of 6.9 is set with a pair of dividers. The upper mark on the paper is kept on the 70 deg. wet-bulb line while the edge of the paper is kept parallel to the verticals from the C scale. When the lower mark is just the distance of the divider points from the wet-bulb line, the conditions of the problem are realized and the final temperature will be 79 deg., indicating an approach to the wet-bulb of 9.0 deg. F.

In the case of the corrected condition, $F = 1.30$, $r = 3.07$, and $m = 3.54$. Then, $C = (10 \times 3.54)/(1.25 \times 3.07) = 9.22$; and the final temperature for a 10 deg. range will be 76.4 deg. F., indicating an approach to the wet-bulb of 6.4 deg. F.

CONTROL OF ORGANISMS

Water in the circuit of a cooling tower system is a stream, flowing continuously. This stream is a living thing, filled with vigor and energy. As the water passes over the tower, countless little cascades and waterfalls adapt the stream flow to the topography of the tower structure. But the tower, open to the winds, washes the air as it passes through. Thus, the stream is exposed to the possibility of pollution by various forms of microbiological organisms. Investigation has shown that water immediately emerging from the ground contains enough plant food to support a large population, and that it is immediately browsed upon by microscopic life.[7] As a result, a mixed population is established. The decks and structural members of a cooling tower offer extensive culture areas for the growth of the microorganisms which disturb the water flow and produce the slimes so often observed in cooling tower circuits.

Thallophytes are plants comprising the algae, fungi, and lichens. Sinnott indicates that there are about 80,000 species in all.[8] The vegetative body is typically a thallus, or mass of tissue with little differentiation into such diverse organs as are found among the higher plants. The thallophytes, as a whole, are separated into two main series: the algae, which possess chlorophyll or a similar substance and thus may live independently, and which include all the seaweeds together with the pond scums and similar plants of fresh water; and the fungi, which lack chlorophyll and therefore exist only as saprophytes (living on dead organic matter) or parasites (living on other organisms) and to which belong the multitude of bacteria, molds, mildews, blights, rusts, toadstools and mushrooms. The fungi have perhaps arisen from several different groups of algae, for the two series parallel one another to some extent in their various characteristics.

Fungi and algae grow and thrive in cooling tower circuits in which control is not present. The cosmopolitanism[8a] of the fresh-water algal flora is most marked. Many species are found in all parts of the world, from the tropics to the polar regions, and in a variety of habitats. Aerial algae are those that obtain their water wholly or in large part from the moisture in the air. The terrestrial, or subaerial, algae are more aerial than aquatic; soil universally contains algae. The aerial algae and the

soil-dwelling algae are able to stand prolonged desiccation. Some soil algae are able to resume growth after drying for 50 years. Moist and inundated surfaces offer a substrate intermediate between the subaerial and strictly aquatic habitats. The aquatic algae are found in flowing waters, ponds and lakes, pools and ditches, and bogs and swamps.

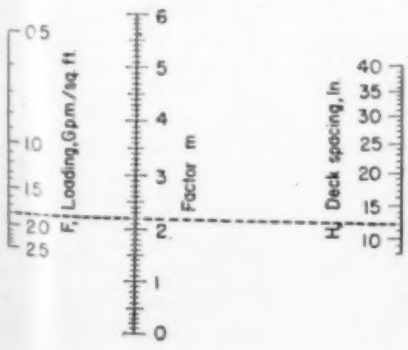
Light is essential for photosynthesis, but some algal species grow only in shaded habitats. Thus, one may not assume that shade will preclude the growth of algae. Temperature has a very important effect in its acceleration or retardation of growth and reproduction, although it rarely plays a direct role in the acclimatization of algae in new localities. Travertine[6b] is formed from the waters of hot springs when algae cause the precipitation of insoluble carbonates for soluble bicarbonates. The deposition of calcium carbonate through the agency of algae may take place elsewhere than in hot springs, and the layer of calcium carbonate may attain a thickness of ⅜ in. or more in a period of three years.

Consideration of the characteristics of the water circuits of atmospheric cooling towers will indicate that the towers offer extremely favorable environments for the vigorous growth of algae. Furthermore, these circuits offer hospitable habitats to the bacteria and fungi. Dust clouds originating in Arizona and New Mexico, or in the western portion of the Great Plains, have traveled east of the Mississippi before falling to earth; diatoms that have been found among the dust particles have been carried more than a thousand miles by the winds. An atmospheric cooling tower is a collector of thallophytes.

GROWTH BY SEASONS

With respect to periodicity, algae fall into six natural groups: (1) Winter annuals that begin their vegetative activity in the autumn and fruit in early spring; (2) spring annuals that begin their vegetative activity in late autumn or early spring and attain their maximum development and reproduce in May; (3) summer annuals that germinate in the spring and fruit most abundantly during July and August; (4) autumnal annuals that begin vegetative development late in the spring and are most abundant in the autumn; (5) perennials, whose vegetative cycle may be, or is, continuous from year to year; (6) ephemerals, that may appear in numbers for a short time at any season.

Fig. 4—Alignment chart for evaluating *m* in Eq. (4)



Thus, in the control of thallophytic growths, a great number of variables must be considered, including: (1) Species of organisms; (2) temperature of cooling water; (3) season of the year; (4) amount of water in the cooling circuit; (5) deck area and number of decks in the cooling tower; (6) side area of the tower exposed to winds; (7) intensity of winds; (8) type of algacide or fungicide used; (9) exposure to sunlight; (10) method of application of control; (11) characteristics of makeup water; (12) climatic conditions.

Fungi, if not controlled, will find sympathetic habitats in the tubes of heat exchangers. Snuggled against the warm tube surfaces, they thrive, taking their food supply from the water stream as it passes. Upon the death of the organisms a residual of scale is left, this scale being the portion of the organism which is inorganic. It is interesting to note that diatomaceous earth, a material of commercial importance, is formed from the siliceous walls surrounding the cell of the diatom, *Alga*. The cell wall remains unaltered after the death and decay of the cell. Great numbers of empty walls accumulate at the bottom of any body of water in which diatoms live.

If X_p is a total chemical dosage used in a period Y, and X is the increment dosage for application of X_p to the system, then X_p/X will be the number of applications. The writer defines this ratio as the "periodic ratio." When X approaches zero, the periodic ratio becomes very large, approaching continuous dosage. Generally, the amount of control chemical to be used is that in which the residual of the active component of the control material is a minimum for effective control. Where the periodic ratio is small, the requirement for X_p will generally increase, since a shock dosage is required when the organisms have had an opportunity to develop and to accumulate between dosages. Of course, the value of X_p has a decided effect upon the cost of treatment. When the time interval between dosages becomes very great, the law of diminishing returns may be evident, since the large values of X_p in shock dosages may not arrest the invasion.

If complete treatment of the water stream (and therefore complete oxidation of the organisms) is possible between the cooling tower outlet and the cooling tower inlet, the effect of the wind upon the potency of the treatment is a minimum. However, where the organisms may not be destroyed exterior to the cooling tower and where batch or intermittent dosages are used, the culture areas of the decks, the vertical area of the tower exposed to the winds, and the intensity of the winds have increased effect upon the values of X_p and X.

Close attention to the subject of treatment will generally pay large dividends to the operator. If scale is deposited in heat exchangers, the heat transfer will be decreased due in increased thermal resistance. Furthermore, the formation of algal or other thallophytic growths on the cooling slats will cause channelling of the water, while discontinuity of the water layers around the slats will develop. The effect of these growths is to reduce the amount of the cooling surface S (see Equation 2). In Figs. 3 and 4, under such conditions, F may be considered to be increased with a consequent increase in r and a decrease in m; these changes indicate the need for an increased number of decks in a tower.

DOSING CHEMICALS

For many years, chlorine or its compounds have been used most extensively and satisfactorily for the control of slimes and growths. At the present time, compounds of an efficient companion halogen, bromine, are commercially available. In a current field research,[10] the writer has observed interesting and effective control using an aqueous solution of dimethyl-9-octadecenyl ammonium bromide.

In summary: (1) Distribution systems of towers should be checked and adjusted to give full coverage of the deck areas; (2) where decks are sagging, they should be reinforced and leveled; (3) extra capacity, but not in the same ratio as the increase in area, may be gained by the addition of intermediate decks in an existing tower volume; and (4) water treatment is essential, and the amount of treatment should be developed through study of the tower and the development of dosage as determined by the empericism for the tower conditions in question.

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Survey Uncovers Potential Uses for ELECTRONIC DEVICES

Many new applications for electronic equipment were suggested in a recent McGraw-Hill survey which drew a response from 796 manufacturing companies, 135 of whom represented the chemical industry. This survey, covering 124 different types of applications, defines the field of industrial electronics both in terms of actual devices in use and the problems of industry that electronic devices might help solve. It seems worthwhile to call attention to some of these suggested applications.—*Editors*

ELECTRONIC devices have found increased use in all branches of manufacturing industries during the past few years. Chemical process industries have shared in this activity and have benefited greatly from developments in this field. In line with the trend, *Chem. & Met.*, in March and April of 1942, reported on "Electronic Devices for Process Control," in which basic principles were set forth, types and classes of devices discussed, and numerous applications outlined. More recently, however, a comprehensive survey has been made by the research department of the McGraw-Hill Publishing Co., Inc., to determine not only present but potential applications of electronic equipment as envisaged by industry itself.

Although this survey was designed to cover all applications in all industries, our interest, of course, lies chiefly in the processing field. Most of the present applications for electronics are fairly well known due to the extensive campaigns carried on by the equipment manufacturers. Looking to the future rather than to the past, it seems most opportune to stress the problems which might be solved by the use of electronic equipment. A number of such problems which suggested electronic solutions have resulted from this survey, some of which seem worth passing on. Some of the suggestions given may not be feasible, but the over-all picture shows that many companies are thinking of electronics as a possible cure or solution to a number of their problems. The accompanying charts and table show the relationship of the chemical industries to the whole industrial field, together with a functional breakdown of the present and potential applications in this field. Some of the more interesting contributions of the process industry participants in this survey are given in the following paragraphs.

An equipment manufacturer reports as follows: "Our problems relate to dielectric heating as an improved means over oven (or conduction) heating. We are working on the development of a plastic molding process. This process is for the molding by injection of large articles (5 lb. and over) of either thermoplastic or thermosetting materials. We have met with a fair measure of success so far. Some of our trials have already involved the use of a 3 kw. Megatherm unit, which was available for these tests. The 7 kw. machine is being installed to carry on these tests and to enable us to broaden our experimental scope. In general, we have learned that we can do certain jobs in minutes which under previous conditions, without the dielectric heater, took as many hours. Since our larger units will soon be ready we fully expect to handle a wide variety of materials with good results."

DIELECTRIC HEATING

A number of suggestions were made concerning the dielectric heating of sheet material. These include curing of resins, sheet plastic, sheet rubber, and other similar materials. A paper manufacturer, however, wants to dry bulk paper. "We have tried to get information and results of experience in electronic heating with the object of drying wet paper in roll form, with the hope that the resulting product might resemble air-dried paper (as compared to paper dried under tension on ordinary steam dryers). However, the cost seemed out of sight." From the various comments there appears to be a considerable field in the application of electronic devices in heating, curing and drying.

The problem of welding glass pipe is brought up by a manufacturer of heavy chemicals, but this can well apply to any user of such materials of construction. "Because there is no well developed method of field welding glass pipe, it is

Classified Table Giving Percent of Companies With Present and Potential Applications; 135 Companies = 100%

Applications	Present	Potential
Heating Total	7.4	21.5
Induction	....	....
Ferrous and nonferrous	....	2.7
Ferrous only	0.7	1.5
Dielectric	....	....
Sterilization	....	1.5
Gluing, drying	....	3.7
Plastics	4.4	4.2
Sheet	0.7	3.7
Textiles, paper	....	4.4
Miscellaneous	2.2	1.5
Controls Total	57.8	54.1
Combustion	0.7	8.1
Electrostatic precipitation	8.9	10.4
Level	13.3	11.9
Electric load	1.5	0.7
Door opening, closing	2.2	0.7
Motion initiating	5.9	3.7
Motor speed	4.4	11.9
Register control	3.0	2.2
Temperature	28.9	14.8
Timing	8.9	2.2
Welding control	1.5	3.0
Relaying	1.5	1.5
Humidity	....	1.5
Flow of Materials	9.6	5.9
Moisture	3.0	1.5
Color Matching	....	3.0
Pressure	....	1.5
pH	3.7	3.7
Regulation Total	10.8	19.3
Generator voltage	3.7	3.7
Skew regulators	0.7	2.2
Speed	2.2	2.2
Slack regulation	3.0	2.2
Voltage, current, phase	2.2	1.5
Process regulation	3.0	9.6
Counting, sorting, weighing, inspecting	13.3	22.2
Counting	2.2	7.4
Flaw detection	3.0	0.7
Sorting and grading	0.7	5.2
Metal detectors	1.5	1.5
Weighing	4.4	7.4
X-ray inspection	4.4	2.2
Molecular Vibration Total	....	7.4
Measurement and Analysis Total	52.6	39.3
Color	7.4	5.2
Conductivity	8.1	1.5
Curve tracing	2.2	0.7
Density, opacity	2.2	5.2
Dielectric properties	1.5	1.5
Gas detection and analysis	4.4	7.4
Humidity	....	1.5
Light intensity	3.0	....
pH	28.9	1.5
Pressure	1.5	....
Reflectors	3.0	....
Resistance	1.5	....
Speed	2.2	0.7
Smoke	3.7	2.0
Sound	0.7	....
Thickness	0.7	....
Time	1.5	....
Titration	10.4	0.7
Turbidity	3.0	0.7
Vacuum and ionization gages	3.0	....
Tube testing	1.5	....
Voltage	3.7	0.7
Waveform	3.0	....
Electron microscope	2.2	1.5
Level	2.2	3.0
Moisture	....	1.5
Flow fluid	....	3.0
Linear and weight measurement	2.2	3.7
Temperature	7.4	3.7
Miscellaneous testing	2.2	....
Chemical analysis	11.9	5.9
Oscillographs	2.2	....
Safety total	26.7	10.4
Combustion	14.1	3.7
Liquid overflow	3.0	....
Detecting intruders	3.0	....
Machinery stopping	3.0	3.7
Fume detection	1.5	0.7
Miscellaneous alarms	4.4	2.2

necessary to order glass pipe in prefabricated sections and join them with flanges. This method is expensive, requires the preparation of numerous detailed drawings, requires many unsatisfactory joints with gaskets to cause delay when a piece is broken."

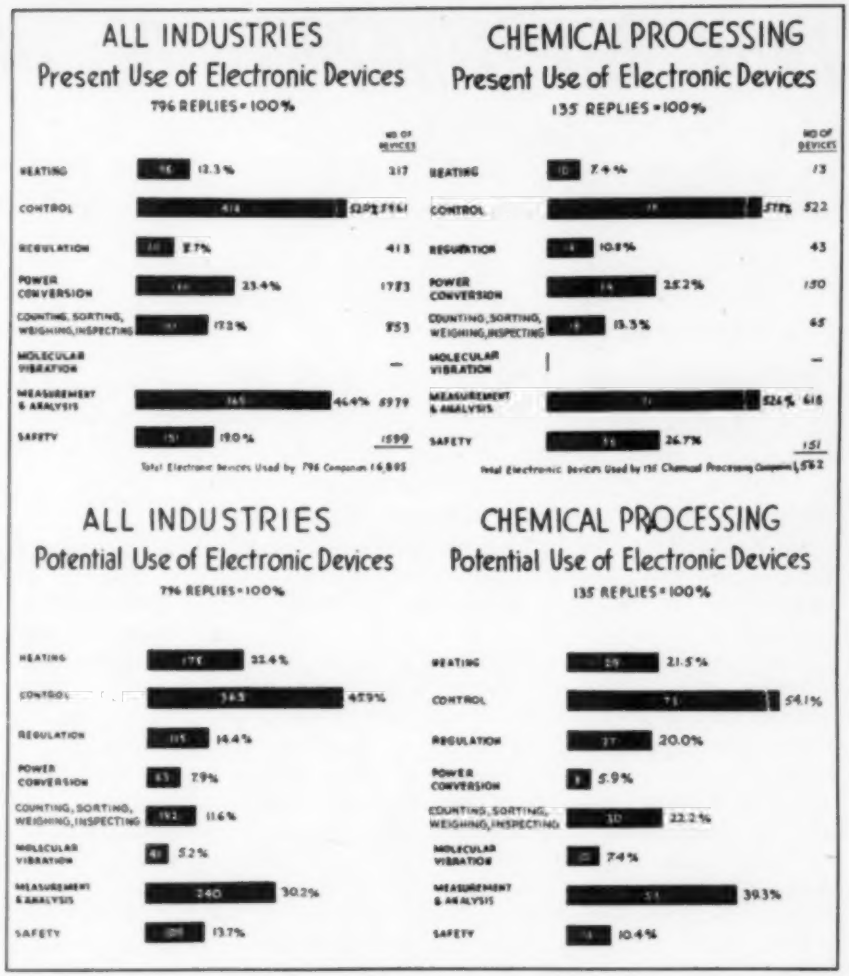
EVAPORATOR CONTROL

Although a condensed milk manufacturer offers the following, similar problems appear in various phases of the chemical industry. "In continuous vacuum pan operation on evaporated milk, an electronic device that would measure the density of the milk and regulate the discharge pump and the milk intake would do the industry a great service. The operation at present is manual and most pan operators tend to over evaporate with a resulting waste of time and power. We need a device which will register the change in concentration of milk in the pan with the reading visible to the operator at all times."

A manufacturer of high-grade fertilizer would like "some method in the manufacture of superphosphate which will keep the proportion of sulphuric acid to dust at exactly the same point. Perhaps this can be accomplished by some control operated by the weight of the dust and operating a valve controlling the quantity of sulphuric acid discharged into the mixture." Undoubtedly there are many other similar problems throughout the chemical industry wherein better proportioning methods could be used to great advantage.

Conductivity of various chemical solutions could also use a better form of control than presently available. A pulp manufacturer offered this problem in cooking liquor preparation. "By electronics, we wish to magnify the minute current that can be passed by the conductivity of sulphite liquor in its various stages of conductivity. By this means we wish to control the opening and closing of 4-in. valves to the liquor line." To a manufacturer of aluminum and potassium sulphate a similar problem exists. "We need a photoelectric colorimeter for plant solutions; a simple photoelectric unit could be devised whereby plant solutions could be controlled for such impurities as iron. Said tests would be conducted by plant operators unfamiliar with chemical technique. Such an apparatus must be rugged and should utilize an electronic galvanometer." Also, a conductivity method of filter washing control is suggested. "In a circuit where soluble K_2SO_4 is separated from insoluble Al_2O_3, the filter washing could be controlled and measured by an electronic conductivity apparatus, the conductivity of the filter cake being measured."

Flow measurement of gases could be improved according to a manufacturer of heavy chemicals. "Flow measurement of gases by the use of electronics would perhaps result in more flexibility of application and accuracy. There is at present a need for a temperature and pressure compensating flow meter for use on gas measurements. If the variables, pressure differential, pressure, and temperature, can be interpreted in electrical units, they can be integrated and read as flow. Electronic amplifiers will be necessary for this integration of variables."



Bar charts summarizing the present and potential uses of electronic devices in all industries and in chemical processing

DEVELOPMENTS NEEDED

Moisture measurement also comes in for suggested improvements. In the manufacture of lightweight, fireproof asbestos sheeting, an electronic device could be used for "moisture-content determination, either as a separate testing device or to signal when the product being oven dried has reached the proper state of dryness. This would save redrying, increase dryer capacity by shortening drying time allowance, and also save fuel. Most drying cycles are set longer than necessary to prevent need for redrying."

Though no present applications for supersonic or molecular vibration devices were reported in this survey some potential applications were suggested. These included the following: "Removal of sludge accumulation from crude oil transports such as barges and tanks by emulsification through molecular vibration, whereby the emulsion so formed may be readily removed by pumping." Also, "Use of supersonics in liquids to hasten chemical reaction; in our case it might be possible to increase production and quality by 50 percent with no additional equipment, except a supersonic agitator to augment the mechanical agitation. Reaction is one of simple solution complicated by floc formation." There is no doubt that molecular vibration devices will find some usefulness in the chemical industry provided they are rugged, reliable and not excessive in price.

From the foregoing comments it may be concluded without a doubt that there are many problems and needs in the process industries which might be solved by electronic equipment. If the future developments by electronic manufacturers advance at the same rate that has prevailed during the past few years they will be well rewarded for their efforts and will gain even a stronger foothold in the process equipment field.

FROM THE VIEWPOINT OF THE EDITORS——

S. D. KIRKPATRICK, Editor • JAMES A. LEE, Managing Editor • THEODORE R. OLIVE, Associate Editor • HENRY M. BATTERS, Market Editor
J. R. CALLAHAM, Associate Editor • L. B. POPE, R. W. PORTER, E. C. FETTER, Assistant Editors • R. S. McBRIDE, Consulting Editor

ONE NATION ECONOMICALLY

THE Interstate Commerce Commission has spoken. Its decision ordering uniform freight rate classifications and the equalization of all class rates east of the Rocky Mountains undoubtedly will have tremendous influence on all industry, the country over. The immediate effect will be the benefaction of the South and West at the expense of the East. In the long run the decision means the economic strengthening of the nation as a whole, for what benefits vast sections of the country is bound to be beneficial to the whole.

The inevitable result of this equality means greater industrialization of the South and West where it is long overdue, for industries in these sections may now have a better opportunity for development through access to the nation's markets on a basis of parity in transportation costs. That some progress had been made previously, notwithstanding what the ICC has labelled "unreasonable and unduly prejudicial" freight charges differentiating the several territories, is proof of the enormous power of the pent-up force behind the movement.

Chem. & Met. has taken advantage of every occasion to call attention to the need for decentralization, to present the potentialities in the mineral, agricultural, and forest resources of the South and West, and to urge the development of a strong chemical industry in those sections. Modern warfare has strengthened our belief in America's need for the greatest possible decentralization of all industry and in particular the chemical industry.

The decision, coming at this time, will enable the South and West to retain and utilize many of their wartime constructed plants. Its potential effects demand immediate reconsideration of every plan for plant expansion or decentralization of manufacturing facilities.

The ICC decision is not a national catastrophe as many may believe, but a great opportunity. Probably no single event since the War Between the States will do more to make this in reality one nation economically and to make it stronger and more uniformly prosperous.

PLANNING A SAFETY CODE

MANUFACTURING Chemists' Association has taken an important step in planning to draft a national chemical safety code. That is a much needed guide to good practice in production, transportation, distribution, and use of materials that become hazardous through even slight misuse.

This is a big undertaking. MCA recognizes that fact. It is moving slowly but constructively on the plan through a carefully selected committee. It will deserve, and it will get, full cooperation from chemical makers and chemical users. The support should be even wider than that. Every element interested in chemicals, even householders, has a concern in the subject.

MCA has already made a splendid start with its two recent manuals on labels for chemicals. It has done a great deal in earlier committee studies and publications. These efforts amply prove that the association is a logical sponsor for the national code.

NEW DESIGN FACTORS

ALREADY alloy steel is more readily available for chemical plant equipment than it has been. In the near future it will be still more readily available, a situation which chemical engineers will cordially welcome.

As postwar equipment designs are developed, it is important that chemical engineers take account of the fact that strikingly modified designs are often very advantageous in the use of the more costly and resistant alloys. Frequently it is necessary to make provision for different methods of fabrication, especially for modified methods of welded assembly.

When making equipment plans from now on it will be smart to take advantage of the special aid which alloy steel manufacturers and other specialty makers can furnish their customers. Frequently much of the greater cost per pound of such metal can be offset by taking advantage of new methods of assembly and new principles of design. Thus the over-all cost is increased must less than would seem to be likely from comparison on the basis of cents per pound. Thus the great advantage of ruggedness and permanence are achieved at a minimum of extra initial expense.

DIVIDED WE FALL

AMERICAN enterprise is again facing the serious problem of international competition or cooperation in a number of industries. Again the issue of basically one of government-controlled foreign monopolies opposing unorganized American business. The result is a very serious handicap on American enterprise.

The facts of such situations in rubber, petroleum, and a score of other commodities are well known in Washington. But many legislators have not yet been told convincingly of the handicaps on our business and the limitations on employment which result. Some effort has been made by important spokesmen of petroleum companies but it remains to be seen whether Congress will understand and act sympathetically.

On every possible occasion chemical engineers and executives of process industries must appropriately present this problem to those who make or influence national policy. Such argument and explanation are essential to offset the clamor of the cartel baiters, especially some of

the noisy ones in the Department of Justice. It must be made clear that a group of companies which compete vigorously in the American market, and must do so under the law, cannot always be expected to compete with each other abroad. If they attempt to apply the American competitive system in international trade they will all be ruined by the overpowering strength of cartels, especially those that are agencies of foreign governments.

WHOSE JOB IS IT?

PROVIDING of jobs for all who wish to work is a big task. New Dealers have tried consistently to place all of the responsibility for providing these jobs, and good wages too, on industry. And often these planners have defined industry so narrowly that it seemed to be only manufacturing industry that was expected to provide work for 60 million persons.

It is stimulating, therefore, to find that the Chamber of Commerce of the United States is taking an aggressive stand on creation of opportunity for full employment on a broader basis. The emphasis is put right where it belongs, on all elements of society. A clear, simple argument makes it quite evident that the whole labor force of America will go to work only when every person consciously plans to provide his share of employment by suitable engagement of those who are going to work for him or his enterprise.

That is the alternative for having the government undertake to create the employment. That is a sound method of using American enterprise. If every thoughtful person will see how and where he can profitably spend some of his own income to give worthwhile employment to others who will serve him, the problem of giving full employment will be solved.

WHAT COST MANAGEMENT?

LARGE corporations are sometimes criticized because of high salaries paid to their administrative officials. Certain industries have been charged with having excessive managerial costs, although we have seldom seen any statistical evidence advanced for such indictments. Because pertinent figures on the costs of management are available from SEC reports, it has been possible for President Donald B. Prentice, of Rose Polytechnic Institute, to prepare a most interesting study that seems to refute completely the popular theory that managerial salaries are exhorbitant.

Writing in the *Journal of Engineering Education* for April, President Prentice cites the figures for a group of 40 typical American companies. In these organizations the ratio of managerial salaries to wages averaged 1.64 percent. In other words, if all those in authority in these industries who received $20,000 or more a year were dismissed, wages would be raised by only 1.64 cents per dollar.

For 16 of the 40 companies, it was possible to determine managerial salaries in dollars per year per workman. The average was $32.53, or about 60 cents per week. Some of the most interesting ratios are those between managerial salaries and dollar volumes of business. The three chemical companies led the various groups with 1.06 percent; the five metal mining and refining companies followed with 0.584. Next came the steel companies with 0.389 percent, six utilities with 0.357, seven railroads with 0.244, and two electric companies with 0.174.

The fact that the chemical industries should have the highest ratio of managerial salaries to sales volume is apparently not due, as is often charged, to their extensive use of research. Were this the case the electrical companies would not be found with the very lowest ratio. Rather, it seems to us, these figures reflect the fact that both chemical and metallurgical industries have larger capital investments per employee that justify the employment of higher paid management.

A BASIS FOR PEACE

EVERY politician who wants to appear as a statesman has his own formula for permanent peace. Most of them lack that spark of incentive which will make both leaders and the common people desire peace and work for it. This makes very impressive a businessman's suggestion that comes from the W. S. Tyler Co. in a recent comment, which says:

"In America we demonstrated that with machine power we could create wealth quicker and cheaper than we could steal it. When this idea becomes world-wide, we think it will do more than anything else to stop war."

If folks are content and have something to work for it seems as though they might stop wanting war at all levels of society. It certainly is an idea worth thinking about.

THREE USES OF COLOR

PAINTING or finishing of buildings and equipment in a process industry plant is primarily done to obtain a surface for protection of the painted or surfaced object. The use of color in such paint or finish is often too casually considered. It is worthwhile to review now and then our reasons for using a colored component, other than to make the finish adequate as a means of protection.

In the first place, color should be used for promoting good will. It is bad public relations to have buildings or equipment that are needlessly unsightly, simply because the color in which they are finished does not take account of the appearance to the neighbors and the passers by.

Second, there is the question of color as a factor in safety. Quite frequently various pipe lines or containers are finished in a distinctive color as a warning to all plant workers. Thus distinctive color schemes are used for fire protection lines, for flammable material containers, or for other designation that is significant in safe operation.

Third, there is the question of comfort and convenience of plant workers. Use of proper colors to secure the advantages of best lighting and most comfortable working conditions is a matter much too often forgotten. It is not an easy matter to make color selections from that point of view. Often times factors of illumination, for better lighting and for elimination of glare, demand very careful choices. But the difficulty does not excuse neglect, particularly since many paint manufacturers will gladly offer helpful suggestions.

When there is again enough paint available to consider proper plant finishes, it will be worthwhile to think more of all three of these factors. They are just as important as surface protection.

CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

$50 WAR BOND FOR A GOOD IDEA!

Until further notice the editors of *Chem. & Met.* will award a $50 Series E War Bond each month* to the author of the best short article received during the *preceding* month and accepted for publication in the *Chem. & Met.* Plant Notebook." Articles will be judged during the month following receipt, and the award announced in the issue of that month. The judges will be the editors of *Chem. & Met.* Non-winning articles submitted for this contest may be published if acceptable, and if published will be paid for at space rates applying to this department.

Any reader of *Chem. & Met.*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are criteria of the judging.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address entries to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

MAY WINNER!

A $50 Series E War Bond will be issued in the name of

WARD E. PRATT
Chemical Engineer
Worthington Pump & Machinery Corp.
Harrison, N. J.

For an article dealing with the solution of a pump abrasion problem, using carbon rings, which has been adjudged the winner of our May contest.

This article will appear in our July issue. Watch for it!

CHART FOR GAS VELOCITIES WITH A PITOT TUBE

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IN ENGINEERING studies it is often necessary to determine the flow rates of gases in pipes, ducts, and stacks at or near atmospheric pressure. The determination of rates of flow is frequently made with a pitot tube, and subsequent calculations. The following equation is ordinarily used to calculate the gas velocity from pitot-tube measurements:

$$V = 15.62C\sqrt{\frac{\Delta p\,(T+460)}{M}}\left(\frac{3.833}{\sqrt{P}}\right)$$

where V is the gas velocity, ft. per sec.; Δp is the velocity head, in. H_2O (differential pressure from pitot-tube manometer reading); T is the gas temperature, deg. F.; M is the molecular weight of the gas; P is the absolute static pressure, lb. per sq.in.; and C is the coefficient of the pitot-tube.

NOMOGRAPH SAVES TIME

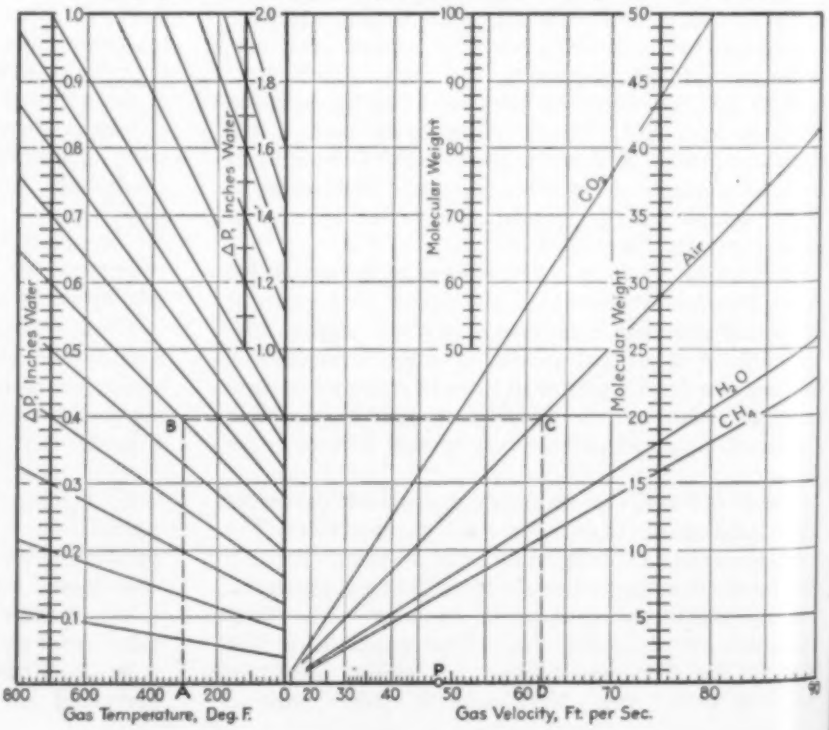
The nomograph presented here was constructed to facilitate determinations of gas velocity from pitot-tube measurements and is based on the equation given above with the assumption that the pitot-tube coefficient C is 1.0 and that the static pressure of the gas is 1 atmosphere absolute (i.e., $3.833/\sqrt{P}=1$). This nomograph may be used to determine velocity directly when the temperature, molecular weight, as well as the velocity head of the gas are known.

An example of the use of the nomograph follows: It is given that the gas temperature is 300 deg. F.; its molecular weight (dry air = 1) is 28.76; the differential pressure is 0.6 in. H_2O; the static pressure is 1.0 atm. abs.; and the pitot-tube coefficient is 1.0. To determine the velocity of the gas, draw a vertical line *AB* from 300 deg. F. on the temperature scale to intersect the radial line corresponding to the differential pressure of 0.6 in. H_2O. From *B* draw a horizontal line *BC* to intersect the radial line corresponding to a molecular weight of 28.76. From *C* draw a line *CD* perpendicular to the gas velocity scale and read the velocity, 62.3 ft. per sec., at *D*.

HOW TO EXTRAPOLATE

A differential pressure intermediate to those represented by the radial lines on the nomograph may be located by visual interpolation or may be represented by an intermediate radial line drawn through

Nomographic chart permits rapid determination of pitot tube results



* The editors regret that unforeseen circumstances have made it necessary to delay publication of the April prize winning article which was announced on this page last month.

point P and the point on the vertical pressure scales corresponding to the differential pressure. (Point P corresponds to absolute zero on the temperature scale.) Likewise, for a gas other than those represented on the nomograph by radial molecular weight lines, a radial line may be drawn through zero on the velocity scale and through the point on the vertical molecular weight scales corresponding to the molecular weight of the gas.

For accuracy warranted when using pitot-tube measurements, the nomograph may be used without correction for pressure when the static pressure is not significantly different from atmospheric since a difference of as much as 1 lb. per sq.in. from atmospheric causes an error of only 3.2 percent in the reading obtained from the nomograph. At a static pressure of 8 in. H_2O, the error in the reading obtained from the nomograph is only 1 percent. For systems at static pressures significantly different from atmospheric, the velocity obtained from the nomograph should be corrected by multiplying it by the factor $3.833/\sqrt{P}$, where P is the static pressure in pounds per sq.in. abs.

When a pitot-tube with a coefficient other than 1 is used, the velocity obtained from the nomograph should be multiplied by the pitot-tube factor.

HOW TO USE RUBBER BEARINGS FOR AGITATOR SHAFTS

BURTON D. MORGAN
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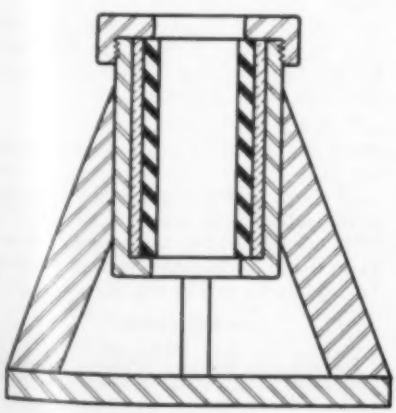
AGITATION of chemicals and slurries is often hampered by the fact that there is no way to support the working end of the agitator shaft. The chief reason has been the lack of a satisfactory bearing or guide that will operate in a mixture of corrosive liquids and solids.

The use of a standard rubber marine bearing for this application will prove satisfactory in many cases. As a matter of fact the bearing as shown, mounted on four legs above a base plate, has given excellent service in a slurry of GR-S rubber latex, brine, and sulphuric acid containing particles of coagulated rubber which are extremely tacky.

In installing marine bearings of this sort

Rubber marine bearings, if properly used, are efficient for submerged agitator service



for duty as agitator bearings, the following points should be observed:

1. Leave plenty of room under the bearing for circulation. These rubber bearings are fluted and particles of any kind will work their way out if they have a chance.
2. Give $\frac{1}{8}$ in. more clearance than recommended by the manufacturer for marine service. For example, if the bearing is for a 2-in. shaft, use it with a $1\frac{7}{8}$-in. shaft.
3. Polish or chrome plate the shaft where it acts as a bearing. For the synthetic rubber slurry mentioned above a stainless steel collar was slipped over the end of the agitator shaft.
4. Never run the agitator when the tank is empty.
5. If oils or solvents are to be agitated use synthetic oil-proof rubber, which is obtainable.

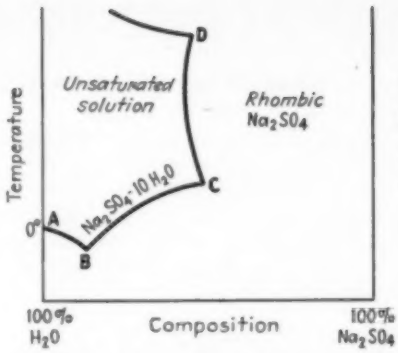


Fig. 1—Phase diagram for sodium sulphate decahydrate

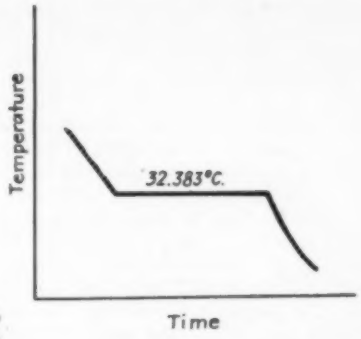


Fig. 2—Cooling curve for sodium sulphate decahydrate

THERMOMETER STANDARDIZING WITH SODIUM SULPHATE

JOHN HOLE
Chemical Engineer
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ALTHOUGH most tests on physical chemistry (e.g., Glasstone, "Textbook of Physical Chemistry," pp. 456, 737, 763) mention the fact that the decahydrate of sodium sulphate has a definite transition point and that this point may be used as a fixed point for standardization of thermometers, few stress the simplicity and accuracy of the method.

Some advantages of using sodium sulphate are:

1. The pure anhydrous salt is easily obtained (it will be explained later why the anhydrous form may be used).
2. The melting point is within the range of ordinary temperatures and thus may be used for thermometers of the 0-60 deg. C. type where ordinarily the ice point is the only fixed point readily determined.
3. The proportions of the salt and water used do not need to be exact, only within certain limits.

A glance at the phase diagram of Fig. 1 shows that if the decahydrate is heated, at point C it will commence to melt and the decahydrate and rhombic anhydrous salt will be in equilibrium with the saturated solution. CD is the solubility curve of the anhydrous salt. If a solution is cooled, say from 40 deg. C. or any temperature reasonably above 32.383 deg., after having been saturated with anhydrous sulphate (an excess being present) the typical cooling curve shown in Fig. 2 results.

When the transition temperature is reached the cooling is arrested while the rhombic form of sulphate goes over to the decahydrate and during this period the thermometer may be tested. A more accurate transition point is given if the salt mixture is constantly stirred while the thermometer is immersed. It should be noted whether the thermometer is to be calibrated for complete immersion or only bulb immersion.

Sometimes the solution cools to 24.2 deg. C. before the eutectic point is reached, when the heptahydrate separates. This can only occur if there is no decahydrate present and if it does occur the solution may be warmed to 40 deg. C. or so and on cooling seeded with a crystal of the decahydrate.

METHOD OF DRYING WET HYDROCARBONS

WILLIAM H. TELL
Chemical Engineer
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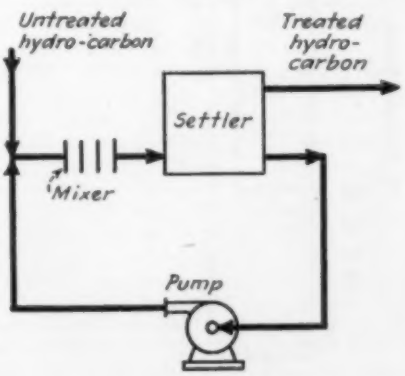
SOMETIMES it is necessary to dry liquid hydrocarbons on a semi-plant scale when the customary methods are inapplicable for one reason or another. When slight traces of certain water-avid materials such as anhydrous ammonia or HCl are not objectionable it is possible to obtain almost bone-dry material by using a recycling contacting and separating method as diagrammed in the accompanying flow sheet.

The desired result can be accomplished

Flow sheet for hydrocarbon drying



by passing the wet hydrocarbon together with the anhydrous ammonia through an orifice mixer and then into a settling drum. The settled ammonia can be recycled until its water content has built up to several percent, as determined by the allowable moisture content of the effluent hydrocarbon. It should be pointed out that a considerable number of materials other than ammonia can be employed, dependent on the properties of the material treated, or its desired end use. As mentioned, anhydrous HCl might be one of these. It happened, however, in our particular case, that ammonia was best for the purpose.

PIPE FITTINGS USED FOR PRESSURE TAP

JOSEPH ALLERTON
Engineer
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VERY often pressure taps are required to be attached to pipe lines. If a priezometer ring is used, difficulty is often encountered, not only with construction, but also with maintenance. If one tap is made directly in the pipe, care again has to be taken to be certain that the inside pipe surface remains smooth, i.e., that no burrs or fittings protrude.

A very simple arrangement which has been found useful and easy to construct is shown in the accompanying sketch. The pipe is first cut at the desired spot. Then one end is threaded for 2-3 in., with no taper, and finished with the usual taper. The end of the other section is cut to a regular pipe thread with perhaps a short section of no taper. Reducing couplings are then secured on these threads and connected by a nipple to which a pressure tap has been attached. The open distance between the two pipes should not be more than about ⅛ in.

With this arrangement no special concern need be given to the pressure tap, since no flow occurs past the tap itself.

NOMOGRAPH FOR FLOW OF AIR IN DUCTS

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Matawan, N. J.

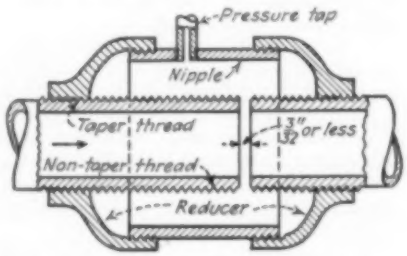
FOR USE in sizing ducts for air flow, for example, in heating and ventilating, a nomograph can be made, based on the equation:

$$h_f = \frac{0.075 f L (V/4{,}005)^{1.84}}{D^{4.81}}$$

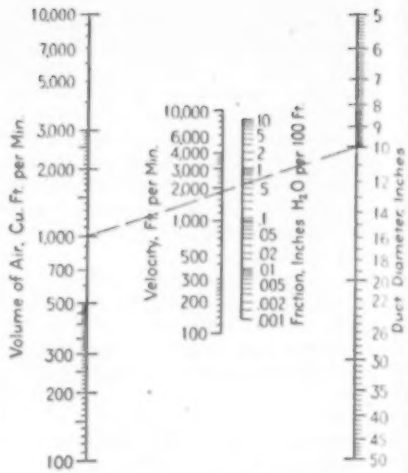
where h_f is the pressure drop in inches of water for air of density 0.075 per cu.ft., L is the length of the duct and D the diameter in feet, V is the air velocity, in feet per min., and f is the coefficient of friction, an average value of which is 0.0192. This equation is given in Marks' "Mechanical Engineers' Handbook," 4th Ed., p. 1664.

If we take the pressure drop in inches of water per 100 ft. of pipe as one of the variables, and the diameter as a second variable, the above equation determines the velocity in feet per min. The equation is of the standard nomographic form for parallel logarithmic scales, i.e.,

$$f(x) = \varphi(y) + \psi(z).$$



Pressure tap of pipe fittings



Air flow nomograph for ducts

This is shown on the accompanying nomograph.

In addition, the volume of air flow, Q cu.ft. per min., is determined when the velocity and diameter are fixed. Therefore, it is possible to draw another logarithmic scale for volume of air flow on the nomograph, such that the extension of the line connecting the velocity, friction loss, and diameter will intersect this line at the corresponding value of Q. Thus, a single line connects the four variables and determines two unknowns when two variables are given.

The nomograph covers a wide range, the duct diameters ranging from 5 to 50 in., and the volume of air from 100 to 10,000 cu.ft. per min.

NOMOGRAPH FOR DETERMINING CRITICAL TEMPERATURES

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New York, N. Y.

CORRELATION of the boiling point, density, molecular weight and critical temperature for non-polar and slightly polar compounds is accomplished by the accompanying nomographic chart which is based on Watson's equation:

$$T_s/T_c = 0.283\,(M/d)^{0.18}$$

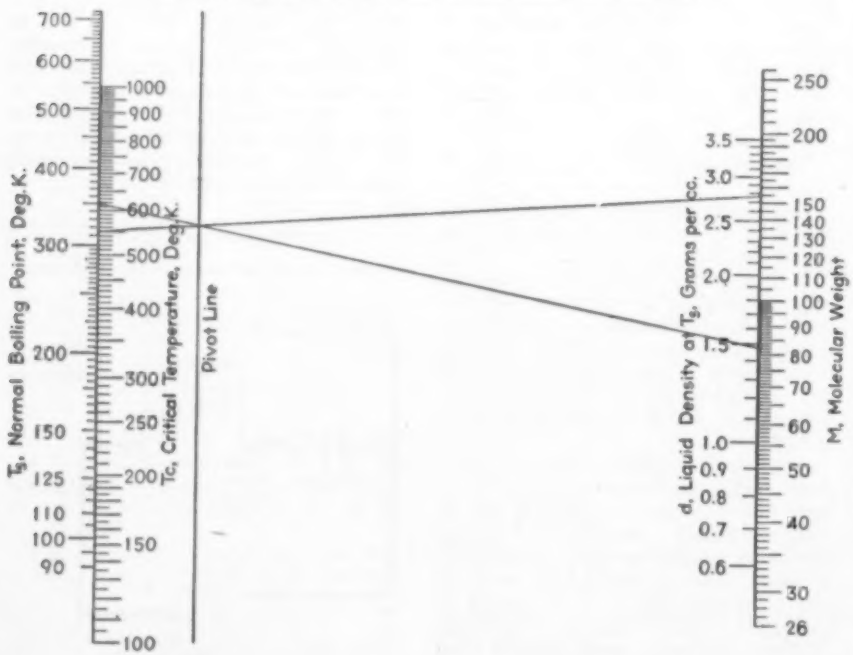
where T_c is the critical temperature, deg. K.; T_s is the temperature, deg. K., at which the substance is in equilibrium with its saturated vapor in a concentration of 1 gm.-mol in 22.4 liters; M is the molecular weight; and d is the density of the liquid, gm. per cc., at its normal boiling point. The T_c scale is not shown on the chart, but the corresponding T_c values are placed according to the equation:

$$T_c = 9.8\,T_s/\ln T_s + 4.2$$

where T_s is the normal boiling point, deg. K.

The use of the chart is indicated for carbon tetrachloride where T_s is 350, d is 1.48 and M is 154. As shown, connect T_s to d and M through the pivot point to T_c, reading T_c as 550 deg. K.

Nomograph determines critical temperatures of liquids


Ts, Normal Boiling Point, Deg. K.
Tc, Critical Temperature, Deg. K.
Pivot Line
d, Liquid Density at Ts, Grams per cc.
M, Molecular Weight

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Hougen and Watson, "Chemical Process Principles," John Wiley & Sons, Inc., New York, 1943, p. 68.

REPORT ON.....

PETROLEUM PROCESSING

Makes Gains of Widespread Significance

No one will ever question the part played by the American petroleum industry in this war. Without the production records and the technological advances made by the 150,000 plant operators and 8,000-10,000 research men in the aviation gasoline program, the struggle would at best still be dragging along. Petroleum developments such as low-temperature greases, improved heavy-duty motor oils, toluol for TNT, butadiene for synthetic rubbers, flame throwers and incendiaries, all have helped to tip the scales toward Allied victory. The purpose of this report is to outline the wartime technological advances of the petroleum refining industry and to high spot those with most potential significance to the postwar process industries.

In the early days of the war it was the superior quality of American petroleum products that staved off defeat. In the battle of Britain, 100-octane gasoline used by the RAF defeated the 87-octane fuel of the Luftwaffe—13 points that saved democratic civilization. Later a combination of both quality and quantity resulted in the utter defeat of the Nazis. Now petroleum products are vital in the Pacific as the lifeblood of our battleships, bombers and bulldozers, in flame throwers to burn out Jap cavemen, as ingredients in explosives and incendiaries for the cities of Nippon.

Figures can hardly indicate the magnitude of the problems that have been solved —as much as 65 percent of the total tonnage of overseas shipping for prosecution of the war has consisted of petroleum products; in 1944 the Navy's need for Diesel oil was 2,100 percent greater than in 1941; our prewar capacity for 100-octane fuel was 46,000 bbl. daily, now is measured in hundreds of thousands; capital investment for the 100-octane gasoline program totals approximately $900,000,000 or about 50 percent more than the cost of the synthetic rubber program.

Now any industry which has invested immense sums for chemical engineering construction, mostly for new techniques, within a period of less than 5 years certainly deserves close economic and technological attention. Of the $760,000,000 invested in plants located in the United States, 74 percent of the investment and 82 percent of the total capacity will be owned by private industry. This development will have far-reaching implications outside the field of aviation. Some authorities believe that the impact of our aviation gasoline program on the chemical industries will eventually be as great in magnitude as that of synthetic rubber.

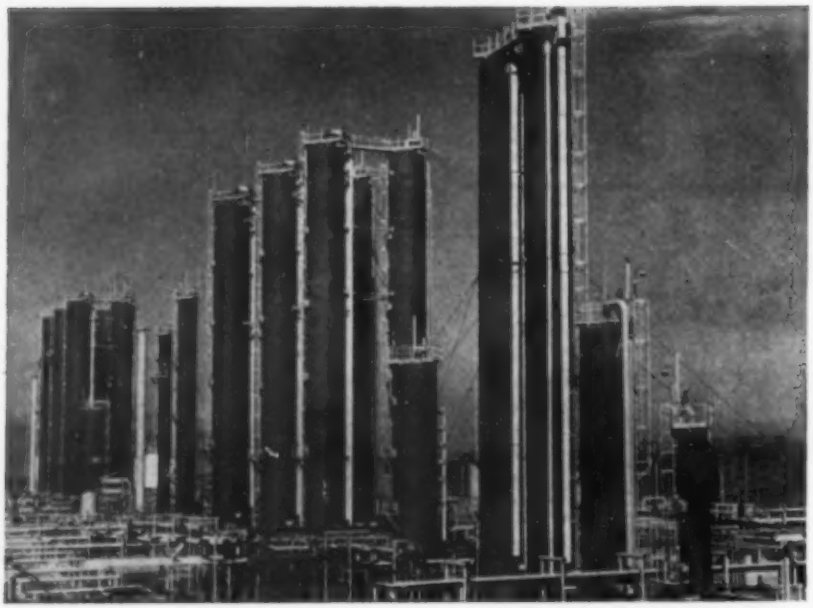
SUCCESS – WHY AND HOW

It might be wise for chemical engineers and executives to first take note of those characteristics of the petroleum refining industry that explain why and how it has become the recognized leader in process progressiveness: (1) Intensive application of chemical engineering principles; (2) large-scale unit production operations; (3) inter-industry cooperation on a scale seldom encountered elsewhere; (4) extensive and liberal research programs; (5) high-caliber personnel from operators to top management.

Nowhere else can one find such advanced and sound chemical engineering applied on such a large scale throughout an entire industry. Results include a high degree of operating efficiency and production economies, flexibility in operating techniques, a technology that is constantly being improved. Next to the chemical industry proper as largest employer of chemical engineers, petroleum refining is probably the nearest approach to a process engineer's paradise. All in all, the industry has an exceptionally high concentration of engineering brains in actual use.

Large-scale manufacturing operations, obviously resulting in low-cost production, permit equipment design and installations that could not be justified in plants of smaller through-put. Yet many of the techniques now used in other industries were originally worked out and demonstrated in oil refineries. In fact, the industry is becoming increasingly important as an exporter of new and improved equipment designs, operating techniques and manufacturing processes. It has long been a chief contributor to the advancement of chemical engineering principles and data.

Few private industries have shown as much inter-company cooperation as the petroleum firms. This has been particularly true during the war, to a large extent



Butadiene from petroleum sources has been a major contribution of the industry. This government-owned plant is operated by Phillips Petroleum Co.

accounting for the excellent record of the industry since Pearl Harbor. Net result of this policy over a number of years is that the entire refining industry has been developing at a uniformly high technological and ethical level. Competition has largely been based on technical advances, inventiveness and ingenuity, rather than upon cut-throat economic pressure.

Research has long been the technological backbone of petroleum processing. From less than 200 technical men engaged in research in the petroleum industry in 1918, there are now 8,000-10,000 researchers located in some of the world's best industrial laboratories and pilot plants. "We've just started," the industry says, and means it! The advantage of such intensified research is that products and processes are constantly being improved; the disadvantage is that the turn-over rate of equipment and processes increases, thus involving rapid obsolescence and large fixed capital expenditures. Advantages have so far greatly outweighed the disadvantages.

Like the chemical industry, petroleum refining requires a keen, technically competent personnel throughout its vertical structure. Even after the disruptions of war, this industry is known for its high wage rates and liberal labor policies. Good labor-management relations, high caliber personnel, structure of the industry and other factors have made it more difficult for "little labor fuehrers" to mushroom in oil refineries.

THE INDUSTRY SPEAKS UP

What are the major wartime accomplishments of the petroleum refining industry? The industry's own answer, as determined through a survey conducted by this magazine, is summarized in an accompanying table. Of these achievements, all replies were unanimous in agreeing that developments in catalytic cracking, alkylation, butadiene manufacture and toluol processes are most outstanding.

The first commercial catalytic cracking plant, put in operation in 1936 at the Socony-Vacuum plant at Paulsboro, N. J., was of the Houdry fixed-bed type. This was the only catalytic cracking process in commercial operation when the United States entered the war. With 14 units in operation at that time and 11 others completed shortly thereafter, this process contributed substantially all the catalytic aviation base stock during the critical shortage period through part of 1944. Thus, while not strictly a wartime development, this process has made an outstanding contribution to the war effort. Of the three major catalytic cracking processes, the Houdry has about 29 percent of the total reactor capacity.

Reactions and engineering features of the Houdry process, already having been fully described, will not be repeated here. Yet this process marked a new period in petroleum refining: (1) It ushered in an era of catalytic processes; (2) its commercialization required a specialized and more advanced type of chemical engineering that is now spreading to other processes and industries. Many chemical engineering unit operations inherent to the nature of the process were highly perfected. These included split-second electrical automatic control of the successive phases of on-stream, purging, regeneration and purging of catalytic chambers; the application of the axial-flow gas turbine-air compressor for enormous volumes of regeneration air under pressure and recovery of the power therefrom; rapid evacuation of large-volume vessels; removal and recovery of heat from regeneration.

On the other hand, the three other catalytic cracking processes (Fluid, Thermofor and Cycloversion) all reached commercialization since the beginning of the war. These processes have made outstanding contributions by providing large

Major Wartime Achievements of the Petroleum Refining Industry[1]

Outstanding Achievements[2]	Outstanding Contributors[3]	Other Principal Contributors[3]
Catalytic cracking		
Houdry[4]	Houdry Process Corp.; Socony-Vacuum Oil	Sun Oil Co.; E. B. Badger & Sons
Fluid	Standard Oil Develop; M. W. Kellogg	Standard Oil (Ind.); Universal Oil Products; Texas Co.; Shell Oil
Thermofor	Socony-Vacuum Oil Co.	E. B. Badger; Lummus; Magnolia Petroleum
Alkylation		
Sulphuric acid[4]	Standard Oil Development; Shell Oil	Texas Co.; Anglo-Iranian; Universal Oil Products; M. W. Kellogg
Hydrofluoric acid	Phillips Petroleum; Universal Oil Products	Socony-Vacuum
Butadiene		
Butane	Houdry Process Corp.	E. B. Badger; Bechtel-McCone
Butylenes	Standard Oil Develop; Phillips Petroleum; Shell Oil	Gulf Oil; Texas Co.; Universal Oil Products; Standard (Ind.); Sun Oil; Atlantic Refining; Pure Oil; Lummus Co.; M. W. Kellogg; E. B. Badger
Other Notable Achievements		
Inter-industry cooperation		All firms, large and small; Petroleum Administration for War; other government agencies
Toluol		
Hydroforming	Standard (N. J.); M. W. Kellogg	Standard (Calif.); Standard (Ind.); Shell Oil; Texas Co.; Universal Oil Products; Humble Oil; Pan-American
Recovery	Shell Development; Standard Development	Socony-Vacuum
Isomerization	Shell Oil Co.; Standard (Ind.)	Universal Oil Products; Texas Co.; Cities Service; Phillips Petroleum; Standard (N. J.); Humble Oil & Refining; M. W. Kellogg
Superfractionation	Most major firms	Most major firms
Heavy-duty motor oil		Standard (Calif.); Socony-Vacuum; Texas Co.; Lubri-Zol; Standard (Ind.); many others
Low-temperature grease		Texas Co.; Standard (Ind.); Standard (N. J.); Socony-Vacuum; Union Oil; Shell Oil; others

[1] Based upon results of a survey made by *Chem. & Met.* of 26 petroleum refining and engineering firms. Credits for contributions include only those submitted by the industry itself. This list is not complete; other developments mentioned but not listed include Cycloversion (Phillips); rust inhibitors; special blending agents; butyl rubber (Standard of N. J.); furnace blacks; chemicals from petroleum (Standard of Calif.; Standard of N. J.; Shell Oil; Union Oil; General Petroleum). [2] Listed roughly in order of importance as determined by number of returns. Some developments cannot be mentioned because of military secrecy orders. [3] Not necessarily in order of importance or value of contributions. listings relative and not necessarily complete. [4] Initiated prior to 1939-40, but largely materialized or making outstanding contributions during the war period.

volumes of high-octane base stock (79-81 ASTM octane rating) for aviation gasoline, isobutane and olefin raw materials for aviation alkylate blending fuels and butylenes for butadiene manufacture. Catalytic cracking is the backbone of the entire high-octane aviation gasoline program.

FLUIDIZED SOLIDS

• Fluid catalytic cracking, having some 50 percent of the country's total catalytic cracking capacity, has been a major contributor to wartime aviation gasoline production. Perhaps as important in the final analysis, it represents the first commercialization of a new chemical engineering tool—the principle of the fluidized solid used either as a catalyst or as a heat transfer medium. This method of handling finely powdered solids as a fluid by the air-lift principle has already been installed in a new phthalic anhydride unit in Chicago. It is expected to become rather widely used in certain types of processes within a few years. Operations such as ore reduction, coking of coal, water gas manufacture and other specialized chemical processes, regardless of operating pressure, may represent interesting applications.

Principal Materials Going into 100-Octane Gasoline Facilities[1]

Item	Dollar Value
Carbon steel[2]	
Plate	$35,000,000
Structural shapes	21,000,000
Bars	6,000,000
Castings	2,200,000
Pipe (including fabricated)	41,000,000
Tubing	5,800,000
Wire products	1,200,000
Other carbon steel	1,300,000
Alloy steel[2]	18,500,000
Copper wire	3,500,000
Copper & copper-bronze products	900,000
Valves	
Steel	46,400,000
Iron	6,000,000
Bronze	1,300,000
Steel fittings	19,000,000
Steel safety	3,500,000
Iron safety	600,000
Electrical equipment	
Motors	5,400,000
Switch gear & motor controls	4,300,000
Other electrical equipment	2,900,000
Other equipment	
Conveyors	8,600,000
Dust collectors, etc.	2,900,000
Pumps	16,000,000
Turbo-blowers	3,800,000
Compressors	19,500,000
Pressure vessels	87,000,000
Heat exchangers & condensers	54,400,000
Instruments	12,600,000
Control valves	7,000,000
Steam boilers	9,000,000
Turbines	5,700,000
Miscellaneous (insulation, lumber, tower packing, etc.)	107,700,000
Total materials	$540,000,000
Direct field labor for erecting	300,000,000
Engineering, design, general overhead cost	160,000,000
Grand total	$1,000,000 000

[1] Petroleum Administration for War, May 1945. [2] Exclusive of carbon and alloy steels going into pressure vessels, heat exchangers and other fabricated items. [3] Of this United Nations' grand total, $436,217,000 was for plants located in the United States. Total includes some still uncompleted plants and also value of U. S. assistance supplied for foreign construction. It excludes foreign materials and labor. Final costs are not yet known on some completed units. Of the domestic plants, 73 percent of the total investment and 85 percent of total capacity will be owned by private industry.

Houdry catalytic cracking unit, some 30 of which now have a nominal once-through charging capacity of over 300,000 bbl. per operating day

The first industrial fluid catalyst cracking unit was started in May, 1942, at the Baton Rouge, La., refinery of Standard Oil of N. J. Now, only three years later, there are 32 units in the United States with a nominal through-put of about 400,000 bbl. daily. Four of these are of the up-flow type, the remainder using the more recent down-flow method. The world's largest single fluid catalytic cracking plant was placed on stream in December, 1944, at the Avon refinery of Tide Water Associated Oil Co.

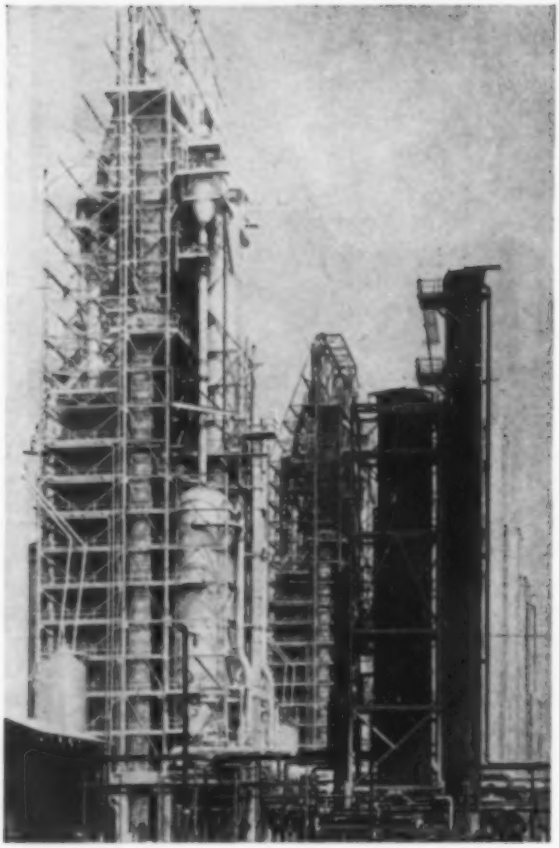
The catalyst, which is of an alumina-silica type, usually ranges between 5 and 50 percent on 100 mesh. The cracking temperature is 800-1,000 deg. F. After the cracking, the catalyst is separated from oil vapors and reactivated by blowing air through it, thus burning off the carbon. Cracked oil is distilled into gases, gasoline, gas oil and heating oil. Yields of principal liquid products are 40-45 percent gasoline and about 50 percent of cracked gas oil.

THERMOFOR PROCESS

Another wartime development in cracking is the Thermofor catalytic process (TCC) in which the Thermofor kiln is adapted to the regeneration of cracking catalysts. In 1941 a 500-bbl. pilot plant was erected by Socony-Vacuum Oil Co. at Paulsboro, N. J. In October, 1943, the first full-scale commercial TCC plant was placed in operation at the Beaumont refinery of the Magnolia Petroleum Co., an affiliate of Socony-Vacuum. At present, there are 34 TCC reactors in operation in the United States. These have a total rated charging capacity of 324,000 bbl. daily, representing about 31 percent of the total reactor capacity of the three major catalytic cracking processes. Some of the TCC units have produced at as much as 170 percent of rated capacity. All production goes into 100-octane gasoline base stock with yields of 30-50 percent of the first charge.

The TCC process consists of passing charging stock vapors upward through a moving (solid bed) of catalyst particles or by passing liquid charging stock or a mixture of liquid and vapor downward through the moving bed. The catalyst is revivified by burning away the accumulated carbon in a regenerator of the Thermofor type, with the heat used for the generation of processing steam. Charge enters the reaction at a temperature of 750-1,000 deg. F. and at a pressure of 10-15 lb. per sq.in. Space velocity may be varied from about 0.2-3.0. Catalyst residence time in the reaction zone may be varied within the range of a few minutes to two hours. Chemical reactions include splitting of the molecule by cracking, alkylation, dealkylation, cyclization, isomerization and polymerization, all occurring simultaneously.

In early 1943, Socony-Vacuum announced a new "bead" synthetic catalyst tailor-made for the TCC process to combine improved performance with a maxi-



Commercial use of synthetic bead catalyst first began in this Thermofor cracker of the Torrance, Calif., refinery of the General Petroleum Corp.

Estimated Proportionate Production of Postwar Gasolines*

Grade	Octane Rating ASTM Motor		Percent Total Production	
	Prewar	Postwar	Prewar	Postwar
Aviation	91-100	100	2	6-8
Premium	80	85-88	10	10-20
Regular	75	78-80	75	60-75
Third	64	68-70	10	5-15

* T. H. Risk, *National Petroleum News*, 36, R132-44, 1944.

mum of resistance to wear. An industrial unit to produce this bead was placed in operation in early 1944. The plant, still the only one of its type, has a nominal capacity of 50 tons of beads daily; actual capacity is considerably higher. Eight TCC plants are now using the new bead catalyst. Both TCC and Houdry units can be converted to use of the new catalyst to increase their performance and to produce the highest quality aviation gasoline base stock made commercially. Simplicity of the TCC process is reflected in ease of operation, low investment and low operating cost. It can be built economically in sizes as low as 1,000 bbl. per day charge.

Phillips Petroleum Co. developed the Cycloversion stationary bed catalytic cracking process, starting a 12,000 bbl.-per-day commercial unit in operation in July, 1944. This is the only unit of its type. It can be operated on fractions ranging from light gasoline to gas oils to produce high-quality blending agents for aviation gasoline and ingredients for synthetic rubber. An important feature of the process is the production of light hydrocarbon fractions having a very high olefin content. The resulting high yields of highly concentrated butylenes and amylenes make possible increased alkylate production. Processing conditions can be varied from 850 to over 1,200 deg. F., from virtually atmospheric pressure to several hundred lb. per sq.in., and from cycles times of 1-12 hr. Most of the equipment required is already available in thermal cracking units so that conversion is relatively simple. Outstanding features of the process include its flexibility, simplicity and cheapness.

Catalytic cracking processes will certainly continue in operating during peacetime to produce a high quality motor gasoline directly from crudes, domestic fuels as well as olefins and isobutane for further processing. Gasoline produced by catalytic cracking is usually about 80 ASTM octane rating as compared to 70 ASTM for thermally cracked gasoline. Furthermore, catalytic processes can produce high quality gasoline from a wide range of feed stocks. There is a definite trend toward improved yields. Catalytic processes are being perfected that are particularly suited for the small refinery, combining flexibility in respect to charging stock and operation with simplicity and ruggedness. These catalytic cracking units can be converted practically overnight from production of aviation gasoline base stocks to production of high-quality motor gasoline.

From the chemical engineering viewpoint, catalytic petroleum cracking is perhaps most important as a pioneering force in new processes and techniques that will spread and infiltrate into all process engineering.

AVIATION ALKYLATE

Aviation gasoline consists of a cracked base stock (70-80 octane), a high-octane blending agent (usually an alkylate of 90-95 octane) and special blending agents to give greater performance and volatility, such as toluol, cumene, isopentane and tetraethyl lead. Just as catalytic cracking is the backbone of the base stock program, so alkylation is the backbone of the blending agent program.

Alkylation is the catalytic process used to combine branch-chain (iso) paraffinic hydrocarbons such as isobutane with olefinic hydrocarbons such at propylene, butylene, pentylene and hexylene to produce longer, higher-boiling isoparaffins with high octane ratings.

The Texas Co. started research on alkylation of paraffins with olefins in 1934; a pilot plant using strong H_2SO_4 as the catalyst began operating in 1937. The first commercial alkylation plant was converted from an existing polymerization unit and placed on stream in 1938 by Humble Oil & Refining Co. at Baytown, Tex. This was followed in 1939 by the Texas Co. plant at Port Arthur. Now there are 39 sulphuric acid alkylation units in the total of about 60 alkylation units of all types in operation or under construction. Over 100,000 bbl. per day of alkylate is being produced by the H_2SO_4 alkylation process.

Acid used in the process is 96-100 percent H_2SO_4. Acidity within the reactor should be 90-95 percent, although it may drop as low as 88 percent for butylene alkylation and 85 percent for amylenes. The concentration of isobutane in the hydrocarbon reaction mixture should be 50-70 percent, but often it is dropped to 25-50 percent to increase production at the sacrifice of quality. The acid-to-hydrocarbon ratio is usually about 1:1. The spent acid may be used in the regular acid-treating processes for naphtha and lubricating oil.

Some 90 percent or more of the alkylate boils within the aviation gasoline range. For instance, under good operating conditions, isobutane and butylenes will give over 90 percent octane. However, at present with emphasis on capacity and maximum production, the yield of octane from butylenes may be only 40-70 percent.

More recently, the hydrofluoric acid alkylation process pioneered by Phillips Petroleum Co. and Universal Oil Products Co. has been industrialized. The first unit started operations at a Phillips refinery in early 1943; now there are some 30 alkylation units using HF in operation or under construction. Many of these have produced at more than twice their design rate and have operated 95-97 percent of the time since their start.

Development of HF as a commercial catalyst in alkylation was of importance to the war effort in numerous ways. One was the fact that refrigeration was not necessary with HF as it had been with H_2SO_4. This saved a considerable amount of critical equipment in building the plants necessary for production of aviation fuel. Of additional importance was the decrease in chemical requirements for the new catalyst, acid consumption being only about one-fiftieth of the consumption of H_2SO_4. This relieved both chemical and transportation industries from producing and moving large volumes of acid for aviation gasoline production. HF can be recovered for re-use by simple distillation.

Hydrofluoric acid is used to catalyze the alkylation, usually at temperatures of 70-115 deg. F. and pressures of 125-175 lb. per sq.in. The acid is purified by simple distillation to remove traces of water and acid-soluble oils. The catalyst is maintained at a strength of 85-95 percent

titratable acidity and is commonly called "anhydrous" although it actually contains 0.3-2.0 percent water as used.

Main material of construction is carbon steel but Monel is used in cases of dilute acid service or temperatures above 200 deg. F. and also as a special trim in valves. Corrosion of equipment has proved to be very small after more than two years of operating experience. Special designs are necessary for packing glands for pumps, valves and for Dura Seals. These involve use of a flush liquid at a pressure of 15-20 lb. per sq.in. above the pressure in the equipment. Centrifugal pumps, gate, globe and plug valves, conventional relief valves, control valves and control instruments have all been used successfully. Recognition of the tendency of steels to form fluoride scale is necessary in selecting equipment where close clearances are necessary. Clearances between moving parts should be great enough to allow for the scale formed. As an alternative, alloys high in nickel should be used.

Postwar prospects for both alkylation processes are promising, although some of the plants now producing aviation alkylate may at first cease or curtail their present over-capacity operations. Others will continue to produce alkylates for aviation fuel for commercial air lines and military purposes. Some may switch to production of blending agents for premium motor fuel, probably by alkylation of both butylenes and propylene. Although alkylate would be blended only in small amounts in motor gasoline, the aggregate consumption could easily amount to most of the present production of aviation fuel.

By operating units to obtain alkylates of lower octane than necessary for aviation fuel, the capacity can be greatly increased and production costs of the alkylate considerably lowered. It is fairly certain that major improvements will be made in catalytic alkylation within the next few years that will result in lower catalyst, raw materials and operating costs. Both the H_2SO_4 and the HF processes will be used, each having particular advantages under certain conditions and localities.

BUTADIENE FOR BUNA

The part played by the petroleum industry in the production and purification of butadiene for synthetic rubber has been a major chemical engineering achievement of the war. One process alone, dehydrogenation of butylene, is used for nearly 40 percent of all the butadiene in the synthetic rubber program. The processes developed and commercialized by petroleum engineers are: (1) Catalytic butylene dehydrogenation, developed largely by Standard Oil Development Co., which is used in the production of over 70 percent of the butadiene made from petroleum; (2) catalytic butane dehydrogenation, developed largely by Houdry Process Corp. and Phillips Petroleum Co. Major contributions have been made by practically all the large oil firms. At present there are five plants producing butadiene catalytically from butylene and three producing directly from butane.

An excellent example of inter-industry cooperation in the petroleum field is the Neches Butane Products Co. at Port Neches, Tex. Formed to produce butadiene from pooled feed stocks of the area, the company was formed on a non-profit basis to operate a 100,000-ton butadiene plant under an agreement with Rubber Reserve Co. The five operating companies include Gulf Oil Corp., the Texas Co., Socony-Vacuum Oil Co., Pure Oil Co., and Atlantic Refining Co. The Lummus Co. was engaged as design and construction engineers. Cost per pound of butadiene manufactured at Neches has consistently been one of the lowest in the butadiene program.

Processes suitable for production of butadiene from refinery butane-butylene feed available in the area were the following: (1) Concentration of butylenes by the Phillips Petroleum Co. process of fractionation followed by extractive distillation; (2) removal of isobutylene by a cold acid process developed from data supplied by Shell Development Co. and Standard Oil Development Co.; (3) dehydrogenation of normal butylene to butadiene by the Standard Oil Co. of N. J. process; (4) recovery and purification of butadiene by the Phillips fractionation and extractive distillation process.

Butane dehydrogenation processes, while not used on as large a scale as the butylene process, are important in that they supply butadiene from a raw material non-competitive with 100-octane fuel. The butylene processes have the advantage of requiring one-step instead of two-step dehydrogenation. The butane processes have been used when butylene supply has been critical.

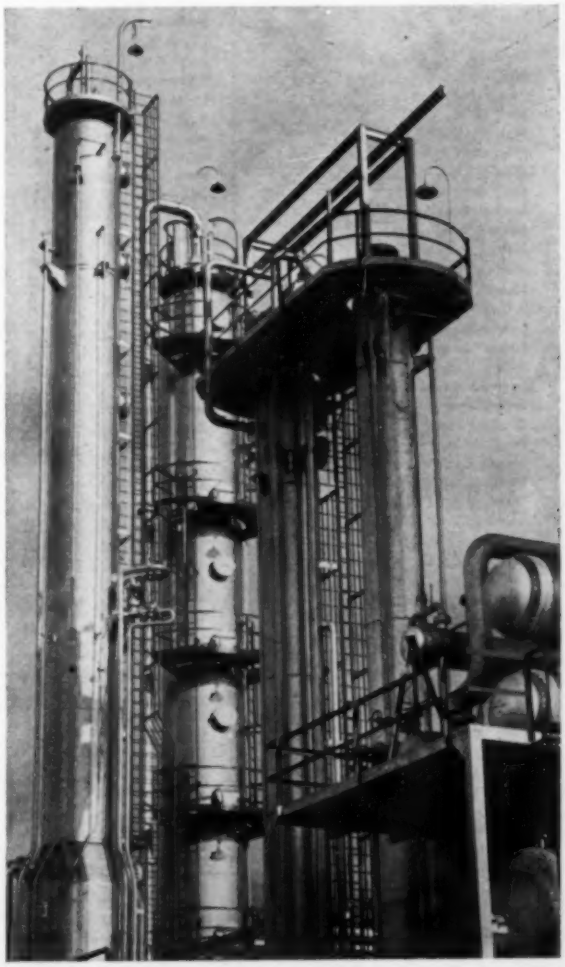
Postwar prospects of butane dehydrogenation are closely interconnected with the future of synthetic rubber, aviation fuel, alkylation and other processes. The crux of the matter will probably be the price of butylenes, which in turn will be affected by demand for these for alkylation, polymerization, butadiene, and for chemical production. Since butylenes for cracking processes may be considered to some extent as being a byproduct, the necessity for butane dehydrogenation for supplying butylenes will depend on the excess demand for butylenes above a normal amount available from the production of motor fuel by cracking. Any large demand for butylenes for outside purposes, such as for synthetic organic chemicals might well have to depend upon butane dehydrogenation. The possibilities of chemical intermediates by dehydrogenation to olefins and diolefins are great.

TOLUOL FOR TNT

Manufacture of nitration-grade toluol from petroleum sources represents the only means by which the enormous volume of this chemical necessary for the explosives program could have been produced. Hydroforming (or catalytic reforming) is a process developed to improve the antiknock rating of low quality naphthas. Normal, straight-chain, paraffinic hydrocarbons in the heavy naphtha boiling range are catalytically changed into aromatic hydrocarbons. By using special naphthas containing relatively large amounts of methylcyclohexane and ethylcyclopentane as feed stocks, the process easily produces large volumes of toluol.

Hydroforming grew out of cooperative research carried out by M. W. Kellogg Co. in the middle thirties, with four major oil companies contributing. Process design was worked out by Kellogg and Standard Oil of Indiana. The first commercial unit was built in 1940 by Pan American at Texas City. When the toluol extraction process was worked out, largely by Stand-

Clean-cut chemical engineering characterizes this fractionator at the Avon, Calif., refinery of the Tide Water Associated Oil Co.



ard Oil of N. J. and Shell Oil Co., hydroforming became of great interest as a means of producing toluol for nitration to TNT. There are now eight hydroforming units in operation. The Baytown Ordnance Works, operated by Humble Oil & Refining Co. and costing $12,000,000, was the first commercial plant for production of synthetic nitration-grade toluol from petroleum.

Hydroforming has two major war roles. One useful contribution is to aviation gasoline, an outgrowth of Pan American's original interest in aromatics for producing unleaded high-octane motor fuel. When used primarily for making toluol, hydroforming still contributes materially to the aviation gasoline program. The heavy hydroformate, containing xylenes and other aromatics, constitutes an important source of rich-mixture ingredients of which there has been a current shortage.

Postwar survival of hydroforming on a large scale seems dependent upon increased catalyst life and decreased maintenance costs. Both improvements seem likely to be made. Operation of most hydroformers has been with the primary thought of producing maximum quantities of toluol and aviation gasoline regardless of cost. There has been no time for perfecting economical operating conditions. Even so, it is very probable that the process will offer refiners a method for the profitable disposal of low-quality naphthas through up-grading to meet the postwar demand.

Other processes have been developed for recovering toluol from petroleum sources. The method developed by Socony-Vacuum comprises two steps. The first is the catalytic cracking of gas oils by the TCC or the Houdry process and the catalytic re-treatment of the more volatile cracked fractions. This leads to the production of stocks of high aromatic content, particularly with respect to benzol, toluol, xylols, and C_9 aromatics. The second step involves the preparation of a narrow cut by superfractionation. The feed stock so prepared is then subjected to azeotropic distillation with methyl alcohol as the azeotrope. After the second azeotropic treatment, the toluol is purified by H_2SO_4 refining and is rerun. A commercial plant was placed in production late in 1943 at the Beaumont, Tex., refinery of Magnolia Petroleum Co.

By means of this type of procedure, it may be possible to produce toluol and xylols in any desired volume of any degree of purity at a reasonable cost. The extent to which this process will be used after the war will depend upon the demand for aromatic hydrocarbons of this sort. If the postwar demand can be satisfied with coal-tar hydrocarbons sold on a byproduct basis, there will be little need for this development.

Catalytic Cracking and Other War Developed Petroleum Plants Now in Operation

Operator	Plant Location	Number of Units: Fluid Catalytic Cracking	Thermofor Catalytic Cracking	Houdry Fixed Bed Catalytic Cracking & Nominal Daily Charge to Catalyst, Bbl. §	Sulphuric Acid Alkylation	Pentane-Hexane Isomerization*	Hydroforming
J. S. Abercrombie — Harrison Oil Co.	Sweeney, Tex.	1					
Ashland Oil & Refining Co.	Ashland, Ky.		2				
Associated Refiners, Inc.	Duncan, Okla.	1					
Atlantic Refining Co.	Philadelphia, Pa.	1			1		
Atlantic Refining Co.	Atreco, Tex.	1					
Cities Service Oil Co.	E. Chicago, Ind.				1		
Cities Service Oil Co.	Lake Charles, La.	3			1		
Continental Oil Co.	Ponca City, Okla.		3†				1
Continental Oil Co.	Lake Charles, La.				1		
Continental Oil Co.	Wichita Falls, Tex.				1		
Cooperative Refinery Assn.	Coffeyville, Kan.	1					
Crown Central Petroleum Co.	Pasadena, Tex.		2				
Eastern States Petroleum Co.	Houston, Tex.	1					
Frontier Refining Co.	Cheyenne, Wyo.	1					
General Petroleum Corp.	Torrance, Calif.		4†				
Gulf Oil Corp.	Port Arthur, Tex.		3	1(10,000)	2		
Humble Oil & Refining Co.	Baytown, Tex.	2			1		1
Magnolia Petroleum Co.	Beaumont, Tex.		2	4(45,000)	1		
Pan American Refining Corp.	Texas City, Tex.	1			1	1	1
Pennzoil Co.	Oil City, Pa.	1					
Pure Oil Co.	Nederland, Tex.		1		1		
Pure Oil Co.	Toledo, Ohio						1
Republic Oil Refining Co.	Texas City, Tex.	1					
Richfield Oil Corp.	Watson, Calif.		4†		1		
Root Petroleum Co.	El Dorado, Ark.	1					
Shell Oil Co.	Houston, Tex.				1		
Shell Oil Co.	Martinez, Calif.				1		
Shell Oil Co.	Norco, La.				1		
Shell Oil Co.	Wilmington, Calif.	1			1		
Shell Oil Co.	Wood River, Ill.	2			2		
Sinclair Refining Co.	Corpus Christi, Tex.			1(11,000)			
Sinclair Refining Co.	E. Chicago, Ind.				1		
Sinclair Refining Co.	Houston, Tex.			1(11,000)	1		
Sinclair Refining Co.	Pasadena, Tex.		2				
Sinclair Refining Co.	Sinclair, Wyo.	1			1		
Socony-Vacuum Oil Co., Inc.	Augusta, Kan.			1(10,000)			
Socony-Vacuum Oil Co., Inc.	E. St. Louis, Ill.		1†	1(10,000)			
Socony-Vacuum Oil Co., Inc.	Trenton, Mich.			1(10,500)			
Socony-Vacuum Oil Co., Inc.	Buffalo, N. Y.			1(10,000)			
Socony-Vacuum Oil Co., Inc.	Paulsboro, N. J.		1†	1(10,000)			
Socony-Vacuum Oil Co., Inc.	Brooklyn, N. Y.			1(10,000)			
Socony-Vacuum Oil Co., Inc.	E. Chicago, Ind.			1(12,000)			
Southport Petroleum Co.	Texas City, Tex.			1(10,500)			
Standard Oil Co. of Calif.	El Segundo, Calif.			1(16,100)	1		
Standard Oil Co. of Calif.	Richmond, Calif.		2†		1		1
Standard Oil Co. (Ind.)	Whiting, Ind.				1	M	1
Standard Oil Co. (Ind.)	Wood River, Ill.	1			1		
Standard Oil Co. of La.	Baton Rouge, La.	3			3		
Standard Oil Co. of N. J.	Bayway, N. J.	1					
Standard Oil Co. of N. J.	Baltimore, Md.	1			1		
Standard Oil Co. (Ohio)	Cleveland, Ohio			2(20,800)			
Standard Oil Co. (Ohio)	Toledo, Ohio				1		
Sun Oil Co.	Marcus Hook, Pa.		2	5(82,800)			
Sun Oil Co.	Toledo, Ohio			1(19,000)			
The Texas Co.	Lockport, Tex.				1		1
The Texas Co.	Port Arthur, Tex.	2			3		
The Texas Co.	Wilmington, Calif.	1			2		
Tide Water Associated Oil Co.	Avon, Calif.	1			1		
Tide Water Associated Oil Co.	Bayonne, N. J.		1	1(16,600)			
Union Oil Co. of Calif.	Wilmington, Calif.		4†		1		
Union Oil Co. of Calif.	Oleum, Calif.						1
U. S. S. R.‡	U. S. S. R.			8(48,590)			
Utah Oil Refining Co.	Salt Lake City, Utah	1			1	N	
Wilshire Oil Co.	Norwalk, Calif.	1					

§ All but four of these units designed and/or constructed by E. B. Badger & Sons Co. ‡ Under construction. *I = Isopentane; M = Isomate; N = Neohexane. †Using synthetic bead catalyst developed by Socony-Vacuum.

ISOMERIZATION

Although the principles of isomerization of paraffins were well known before the war, it was not until 1940 that the first commercial isomerization plant, which produced isobutane from butane, was put in operation at the Soengei Gerong Refinery in Sumatra, an affiliate of Standard of N. J.

Isomerization converts straight-chain paraffinic hydrocarbons such as butane, pentane, and hexane into branch-chain paraffinic hydrocarbons such as isobutane, isopentane and isohexane through the use of solid catalyst. It is now used chiefly to offset the insufficient supply of isobutane for use in alkylation units producing aviation alkylate. Units for the preparation of isopentane and isohexane are also being satisfactorily operated. The liquid phase operation has been found more suitable for these particular products. Approximately 34 isomerization units are now operating in this country.

Butane isomerization has been operated

under vapor phase, liquid phase and mixed phase conditions; the aluminum chloride has been supplied in granular form, in solution, as an absorbed layer on a solid support, and in the form of an aluminum chloride-hydrocarbon complex.

Processes for isomerization of pentane and hexane were worked out by Standard Oil of Ind. The first commercial unit, of which there are now three, began production in 1944. The Isomate process converts normal pentane and hexane to "isomate," a mixture of C_5 and C_6 isoparaffins high in octane number. Isopentane also increases the vapor pressure and permits use of heavy aromatics which otherwise would be too low in vapor pressure for aviation gasoline. The Neohexane process gives some promise that it may help to overcome the shortage of triptane by supplying neohexane for the higher grade gasoline needed against Japan. The Avon, Calif., refinery of Tide Water Associated Oil Co. has a pentane isomerization unit of Shell Oil Co. design, the first of its type. Aluminum chloride is the active ingredient in the catalyst.

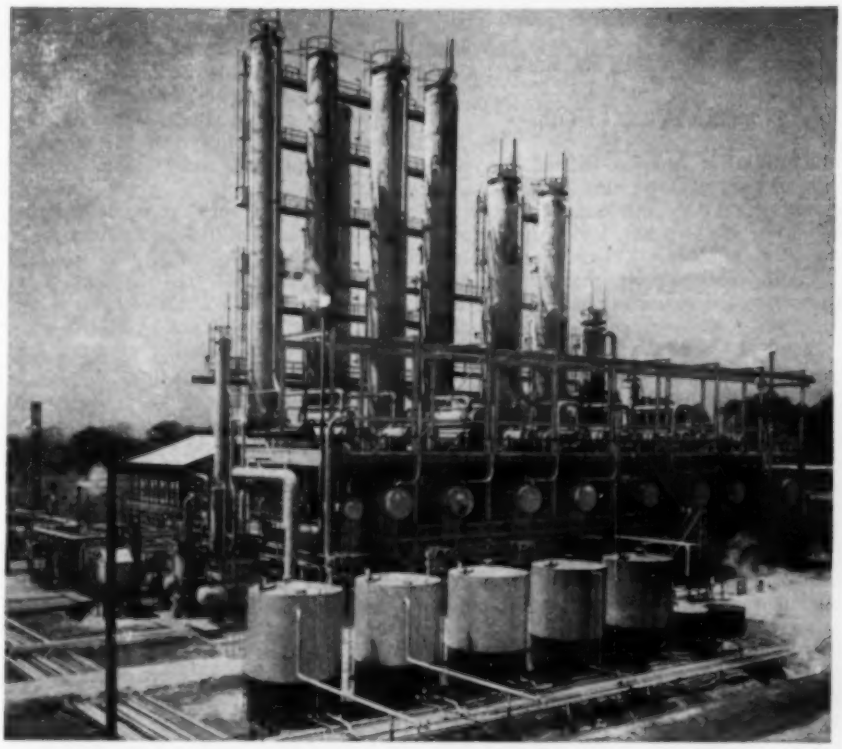
Postwar utilization of butane isomerization is connected closely with the future of the alkylation process. However, the development of this process has resulted in techniques of handling this type of reaction and the catalysts involved. This experience is very likely to prompt considerable use of the isomerization of other hydrocarbons.

Aside from its contribution to the war program, the Isomate process has qualifications as a desirable postwar refining process. Since the high-octane isoparaffinic and naphthenic isomate has high volatility, relatively low Reid vapor pressure, and good tetraethyl lead susceptibility, it is a desirable ingredient for premium motor fuel. The very high liquid yield (approximately 97 percent) gives an advantage which may become particularly important as crude becomes scarcer and crude prices rise. Another potential field is in the natural gasoline business, where large volumes of low-octane pentanes and hexanes can be converted to more valuable gasoline constituents. The process may also find postwar application in the petrochemical field.

SUPERFRACTIONATION

Of particular interest to chemical engineers is the extent to which the principles of superfractionation have been developed and applied industrially for separation of isobutane for alkylation feed, isopentane for direct blending in aviation gasoline, and high isoparaffins from natural light naphthas. Phillips Petroleum Co. has been one of the pioneers in this field.

Prior to the outbreak of war, isopentane was being separated from natural gasoline in a high degree of purity on a commercial scale. Soon after 1940, however, the production of 100-octane fuel necessitated the separation of other fractions. Superfractionation of gasoline was extended until "isohexane," "isoheptanes" and even "iso-octanes" fractions were being produced on a commercial scale. These were characterized by high engine performance and contributed greatly to early quantity production of 100-octane fuel. Byproducts were normal pentane, normal hexane and normal heptane fractions. Along with superfractionation has gone a general trend toward production of pure hydrocarbons in the industry, for example, butadiene, toluol, isobutane for alkylation, and normal butane for isomerization.



Unit for the azeotropic recovery of toluol of nitration grade for TNT; part of the refinery of the Magnolia Petroleum Co. at Beaumont, Tex.

This process is based solely on the arrangement of boiling points of the saturated hydrocarbons. On a butane-free basis, isopentane is the lowest boiling hydrocarbon and can be removed in a pure state. It has an octane number of about 94. Normal pentane is next and has a low-octane number of 64. The next higher boiling hydrocarbons are the isohexanes plus cyclopentane. These all have high-octane numbers and may be removed in a group, free of normal hexane which boils at a higher temperature and has a low-octane number. This fortunate arrangement of physical properties allows separation of fractions containing virtually only branch-chain paraffins and cyclic hydrocarbons from other cuts containing mainly straight-chain hydrocarbons.

United Nations 100-Octane Aviation Gasoline Construction Program by Type of Installation*

Type	Total
Alkylation	75
Isomerization	37
Fluid catalytic cracking	37
Thermofor catalytic cracking	17
Houdry catalytic cracking	13
Houdry catalytic cracking (revamping)	4
Hydrogenation	4
Dehydrogenation	2
Miscellaneous	16
Total	204

* Petroleum Administration for War, May 1945. Some of the installations include more than one unit of a particular type. Most of the new units are located in the United States. This list does not include units already contributing to 100-octane production before the war construction program. All but 19 (4 in U.S.S.R.) of the above units have been completed.

A much higher degree of fractionation was required to separate these cuts than had previously been used in the industry. Previous gasolines, even special aviation fuels, had been made largely on columns of about 30 plates at reflux ratios of 1:1 or less. Superfractionation required columns of 50 plates or more and reflux ratios of 10:1 or higher. Main problems were the location of the cut points to obtain the quality of product desired and the development of controlled methods for distillation in which a 1 deg. variation in tower conditions would have a large influence on product quality. In the design of large columns, some having 100 trays or more, a special technique was developed in handling such unwieldy structures. They were built in two or more sections, each standing separately, although the group was operated as a single column.

Justification of the added processing cost of fractionating gasoline into cuts depends mainly on higher prices of aviation fuel. This does not mean that the process will be abandoned. One means of producing high-octane motor fuels from low-quality, straight-run gasolines would be superfactionation combined with isomerization or other treatment of the normal paraffin cuts. The cost of this may compare favorably with catalytic or thermal cracking of these low-octane gasolines; the yields would be much higher. An additional factor is the probability that some

of these pure hydrocarbons or narrow boiling-range fractions will prove to be of value for production of organic chemicals.

HEAVY-DUTY OIL

Shortly after America entered the war there developed a pressing need for improved heavy-duty lubricants for use in military trucks, tractors, tanks, submarines and other equipment. One of the most dramatic lubricants is the non-floating grease supplied to our submarines to avoid detection.

Standard Oil of Calif. pioneered in the development of compounded heavy-duty lubricating oils such as RPM Delo (Diesel engine lubricating oil). This oil was chosen by the Navy as the required lubricant for submarines, materially increasing their cruising range. It then became the chief lubricant for both Army and Navy heavy-duty equipment, Diesel and gasoline.

Prior to 1940, there had been a limited use of detergent-type additives for motor oils, particularly Diesel oils, to improve cetane rating (ignition characteristics) and other properties. In the latter part of that year, Socony-Vacuum Oil Co. began operations of a commercial plant, using an additive based upon barium instead of the prewar tin salt. Monsanto Chemical Co. operates the plant to make the principal ingredient for this heavy-duty additive. The Army has now standardized on a single all-purpose type of heavy-duty oil suitable for use in automotive and Diesel engines of every type.

In a typical example of the manufacture of a detergent-type additive, paraffin wax passes into a vessel where it is chlorinated to a chlorine content of 13-16 percent. The chlorinated wax is then reacted with an aromatic compound such as phenol. The result is an alkylated phenol with long paraffinic side chains containing 20-30 carbon atoms. The wax phenol is drawn into a reactor where it is combined with a barium salt to form barium wax phenate. This is treated in a filter tank with a clarifying agent and passed through a press to a blending tank where its strength is adjusted. The product then goes to storage and to tank cars for shipment.

Postwar prospects for these developments are excellent. Beyond any doubt, most of the major oil companies supplying heavy-duty oil to the armed forces will, in the immediate postwar period, adapt the oils now being used for military vehicles for use in civilian vehicles of all sorts with little or no change in formulation.

LOW-TEMPERATURE GREASES

Global characteristics of the war and high altitude operations of aircraft over extreme temperature ranges have emphasized the need for adequate low-temperature greases. Aircraft and their cameras and guns must be operated at temperatures as low as —90 deg. F. Each medium-sized bomber contains 1,500 or more precision anti-friction bearings on vital control elements which must be lubricated.

It was found shortly before Pearl Harbor that greases prepared from lithium soaps have improved performance, in general having high melting points and good water resistance. They are of such a nature that a low-pour, low-viscosity oil can be incorporated to give the desired low-temperature characteristics. However, the lithium greases available at the time of Pearl Harbor had some rather serious defects.

Developments, such as made by the Texas Co., obviated to a great extent these early difficulties. A composition was developed which permitted manufacture in an ordinary grease kettle at relatively low temperatures. The newer product is satisfactory for the lubrication of gears and other mechanisms where shear stability is an important factor, whereas the earlier greases were unsatisfactory.

A pilot plant was in operation on the improved low-temperature method shortly after Pearl Harbor. Due to the simplicity of the process it was possible to adapt available plant equipment for commercial manufacture. The Texas Co. now has a commercial unit in operation at Port Arthur to manufacture the improved low-temperature grease. Lithium hydroxide monohydrate is usually used to saponify the fatty material for preparation of the soap base. The preparation of the soap from lithium hydroxide and a suitable fatty material such as stearic acid or a glyceride constitutes the chief chemical reaction.

Two processes are employed in the manufacture of low-temperature greases, the first being the high-temperature method and the second being the low-temperature procedure. In the high-temperature procedure, special reactors, coolers and homogenizers are employed. The low-temperature technique utilizes only an ordinary steam heated grease kettle, equipment available to most petroleum refiners. In this process a low pour, low viscosity oil component is charged to the lithium soap with agitation to give a soft consistency product of the desired characteristics.

It is believed that low-temperature greases will find considerable application in the postwar era. Certain low-temperature equipment such as refrigerating equipment will undoubtedly enjoy a wider use; the present greases should find application in such instances. This, of course, is in addition to the anticipated demand for aircraft lubricants which undoubtedly will persist after the cessation of hostilities.

SPECIAL BLENDING AGENTS

Other than toluol, isopentane and other blending agents, engineers of the petroleum refining industry have developed many other blending materials for special purposes. The best known of these is cumene or isopropyl benzene, made by alkylating benzene with propylene. Early in 1942 it was discovered that this blending agent had a highly beneficial effect in improving certain operational characteristics of aviation fuel. Production got under way by the middle of 1942, the first plant to go on stream being at the Norco Refinery of Shell Oil Co. At one time, 19 plants were turning out cumene to tide the aviation gasoline program over a difficult transition.

Use of this agent alone accounted for almost 23 percent of the increase in 100-octane fuel output during the period 1942-43. Now, with more catalytic crackers and alkylation units on stream, the role of cumene is drawing to a close. Some of the cumene plants have been reconverted to their prewar use, others scrapped.

Another new hydrocarbon of superior anti-knock qualities has been put into large scale manufacture by Phillips Petroleum Co. Triptane, or trimethyl butane has recently been produced on a small scale by a process developed largely by Universal Oil Products Co. and General Motor Laboratories. During 1943 certain aromatic amines, principally monomethyl-aniline and mixed xylidines, were developed for upgrading aviation fuel.

It is unlikely that these chemicals will be used for blending purposes after the war. In most cases, the cost would be prohibitive. Actually there will probably be no need for such materials for a good many years. Catalytically cracked base stock, blended with some alkylates and tetraethyl lead, will most likely be sufficient for motor gasoline for some time.

Many other developments have, naturally, been made by petroleum process engineers during the war. Butyl rubber, a product of the Standard Oil Development Co., has been found to be particularly suited for making inner tubes; it will probably continue to be important for this purpose after the war. A major factor in the production of finished rubber goods has been the development by Phillips Petroleum Co. and others of processes for producing high modulus furnace blacks especially suited to synthetic rubber compounding. The supply of blacks has actually been a bottleneck in production of rubber goods.

Recent advances made in rust preventive materials have proved a major importance in the war effort; these will certainly carry over into postwar practice. Inhibited turbine oils are doing an outstanding job in tankers and destroyers. Engine preservative oils are used to protect internal combustion engines of tanks, aircraft and trucks during overseas shipment. New rust-proofing compounds protect exposed metal parts of mechanized equipment during use and storage.

Production of cutting oils prior to 1940 was in general a matter of formulation. New chemical additives have recently been utilized which have imparted superior properties to such oils. At one key plant, by changing to a better cutting oil, the number of axles machined per tool grind was increased 140 percent. Other cases involving production of shells, aviation engine parts and other materials are on record in which production increases from less than 10 percent to as high as 300 percent were traceable directly to improvements in cutting oils.

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PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

UNIT VACUUM SYSTEM

SMALL, compact high-vacuum pumping systems designated as Type PS, assembled for direct connection to the system to be evacuated, have been developed by the Vacuum Engineering Division of National Research Corp., Boston 15, Mass. The units are available in various capacities and for various ultimate vacuums, and consists of a mechanical forepump, a diffusion pump, high vacuum valves, gages and a control panel. If desired, the unit may be equipped with mechanical refrigerated traps. Installation is simplified since all connections except the one to the equipment to be evacuated are made at the factory. The unit is fully automatic and incorporates various safety and protective features. Vacuum conditions are indicated continuously on a control panel and recorders may be provided if desired.

Unit high-vacuum system

NOVEL GRINDING MILL

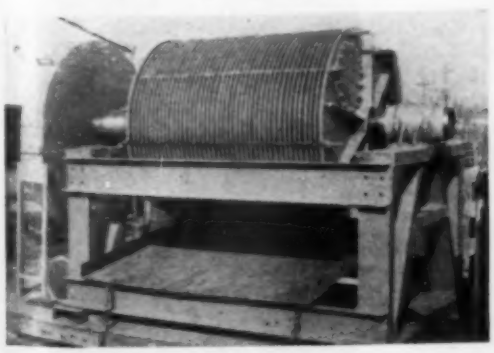
HAVING completed field tests of several years' duration, the Johnson Foundry & Machine Co., 1115 North Main St., Los Angeles 12, Calif., has now announced the D'Ore Mill, which combines grinding and size separation in one unit and permits a complete ore dressing job in one pass through the mill. Thus, circulating load is eliminated and it is claimed that a uniform product is produced and discharged directly from the mill to the next process step without overgrinding.

The new mill, which is available in a wide variety of sizes, operates on what is believed to be a totally new principle in grinding equipment. The mill consists of a cylindrical drum composed of a number of parallel rings mounted with controlled gaps between the rings and spaced to the desired delivery size by means of shims. The openings between rings are wedge-shaped to avoid plugging. The assembly of rings is closed at either end by means of a mill head and the whole is carried on a hollow shaft through which the feed enters. Within the drum thus formed is a heavy grinding roll the length of the drum and with a diameter about one-third the mill inside diameter. This roll is free to move and rolls upon the charge as the grinding drum rotates. For example, with a drum 48 in. in diameter rotating at 40 r.p.m., the grinding roll, which is 16 in. in diameter, will rotate at 120 r.p.m. and will ride at a point slightly above bottom center on the ascending side.

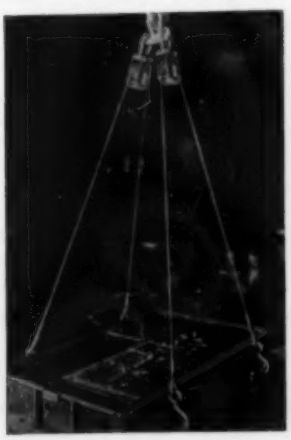
Material entering the mill falls to the bottom where it is ground between the outer cage surface of the grinding drum and the heavy roll so that the material itself serves as a cushion, preventing metallic impact. Continuous discharge takes place around two-thirds of the periphery of the drum. The mill is able to take material as large as ¾ to 1½-in. and, by using the proper shims between rings, can grind in various meshes from 10 to 100.

In addition to eliminating circulating load and classifying equipment, the mill is claimed to have minimum water requirements, to give precise mesh control, (which is adjustable for wear), to minimize mill wear, and to produce a uniform product with, it is stated, a lower power requirement than any other grinding unit of like capacity. Because the mill is started empty in most cases, or practically so, there is claimed to be little starting torque.

New one-pass grinding mill



"Level-Lift" sling



LEVEL-LIFT SLING

TWO NEW sizes, ¾ ton and 1½ ton, have been added to the line of "Level-Lift" slings made by the Macwhyte Co., Kenosha, Wis. As shown in the accompanying illustration, this device consists of a special type of double block through which two lengths of wire rope equipped with hooks at the ends are reeved. When a load is to be lifted, the crane operator spots the crane hooks over the approximate center of gravity of the load, to which the hooks are then attached. When the load is lifted, the ropes automatically adjust through the level-lift block. In so doing, if one sling length of rope becomes longer than the other and as the weight of the load pulls on the ropes, the sheave in the block pulls down against a brake which prevents slippage. The load is then lifted level. Should the crane hook not be close enough to the center of gravity initially, it is only necessary to lower the load enough to relieve tension on the block which then releases the brake and moves the crane hook over a little to the true center of gravity. On reapplying power the ropes readjust themselves and the load rises level.

TEMPERATURE ANTICIPATOR

A SIMPLE means of improving the temperature control of furnaces, which is a variation of the familiar heat-anticipator often employed in room thermostats, has been developed by M. J. Manjoine, research engineer of Westinghouse Electric Corp., East Pittsburgh, Pa. The device consists of an evacuated tube containing two thermocouples spaced at equal intervals from a heating element. The two thermocouples are connected opposing each other in series, and are placed in series with the control thermocouple in the furnace. The heater is energized by the same power source which connects the control mechanism and the relays that operate the main power contactors. Thus, when heat is being supplied to the furnace, it is also being supplied to the small heating element in the vacuum tube. When heat is shut off from the furnace, it is also shut off from the heater element.

It was mentioned above that the two

thermocouples in the anticipator element are connected in series with the control thermocouple at the furnace. It should be explained that one of these anticipator couples is of low thermal capacity and is connected in additive fashion with the control couple, while the other is of high thermal capacity and is connected so as to subtract its voltage from that of the furnace couple. When these two anticipator couples are at the same temperature, they offset each other and the voltage at the control instrument is that of the control couple. When the heater coil is energized (when heat is supplied to the furnace), the anticipator couple of low thermal capacity heats rapidly and so increases the control thermocouple voltage and shuts down the furnace heat supply before the indicated temperature is reached. Thus, what would otherwise mean an overshoot in temperature, now carries the furnace (when the constants are properly chosen) to substantially the correct temperature.

When the heat supply to the heater coil is shut off, the anticipator couple of larger thermal capacity cools more slowly and its reverse polarity causes the control mechanism to again supply heat to the furnace before the normal minimum limit is reached. A variable resistance in the heater circuit of the anticipator provides a means of controlling the frequency of operation of this device. It is claimed by the manufacturer that applications, such as furnaces, where considerable heat storage exists, have been improved in sensitivity and response by as much as 1,000 percent by the device described.

CAST STEEL TRAP

For use at pressures up to 600 lb., or where all-steel fittings are desired, a new cast steel steam trap of the inverted bucket type, provided with side inlet and side outlet type pipe connections, has been announced by Armstrong Machine Works, Three Rivers, Mich. The three sizes include ½, ¾ and 1 in. traps with either screwed or flanged connections. The inverted bucket and valve lever are of 18-8 stainless steel while the valve and seat are of hardened chrome steel, ground and lapped. One of the features of the trap is that the cap and interior mechanism can be removed for inspection or repair without breaking either inlet or outlet connections. The cap and working parts are removed as a unit by unbolting the cap, leaving the body intact on the line.

PRINTER-DEVELOPER

For those concerns which make their own black and white prints in medium quantities, Charles Bruning Co., 4754 Montrose Ave., Chicago 41, Ill., has developed the Model 41 printer-developer which combines individual printing and developing units in a modern design of cabinet built with a sturdy-all steel frame of box girder construction. This machine has a printing speed range up to 6 ft. per minute, depending on the transparency of the original, printing either roll stock or cut sheets, with a printing width of 46 in. A 2,000-watt mercury vapor lamp within a 6-in. glass cylinder assures uniform light distribution over the entire printing area. Cooling air is pulled into and through the cylinder and the contact bands to minimize machine temperature. Printing speed is controlled by a single knob. Anti-friction bearings, easily lubricated, are used throughout, while the ball-bearing motors require no lubrication and the cylinder is easily accessible for cleaning. Plumbing connections are unnecessary and there is no need for outside outlets for exhaust fumes because there are none.

SUCTION DEVICE

When containers are washed before reuse, it is generally necessary to remove the last of the washing liquid by positive means. To accomplish this as quickly as possible, Leiman Bros., 112-79 Christie St., Newark 5, N. J., has developed a simple device consisting of a gasoline- or electric-powered rotary pump mounted on a truck, together with a liquid receiving tank, a rubber suction hose and a special suction tool. The tank catches and holds the liquid residue which may be drawn off from it by means of a plug cock when a quantity has accumulated. The pump is automatically lubricated and provided with a relief valve to regulate the degree of vacuum produced.

CAST CONNECTORS

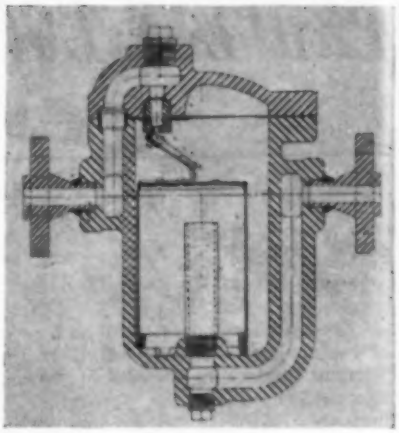
To assure the strength of electrical connections made by means of cast connectors, the Burndy Engineering Co., 107 Bruckner Boulevard, New York 54, N. Y., has adopted a new high-strength alloy known as Burndy 113-L which is the same as this company's copper alloy No. 113, but with the important addition of lithium. The added lithium is said to provide a far denser and finer grained casting, with an increase in tensile strength of almost 20 percent. Elongation also is increased about 20 percent while the coefficient of friction is reduced. In spite of these advantages, there is no appreciable change in electrical conductivity. Owing to the greater strength and toughness, the connectors conform more readily to the conductor and can be installed with greater applied pressure.

MOBILE FIRE EXTINGUISHER

To enable prompt first-aid fire-fighting equipment to be carried to ordinarily inaccessible fires within the plant in a matter of seconds, The Buda Co., Harvey, Ill., has announced a mobile fire-fighting unit consisting of a gasoline-powered truck capable of traveling down narrow aisles at speeds up to 15 miles per hour. The truck is provided with its own water supply tank, 120-g.p.m. pump and 200 ft. of 1½-in. hose provided with a combination fog or straight-stream nozzle. The hose may be connected to a hydrant if desired.

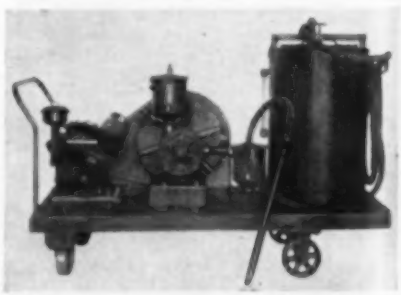
CONTROL TIMER

For the automatic stopping at a preset time of manufacturing operations which are initiated by a momentary contact push-button, the Reynolds Electric Co., 2650



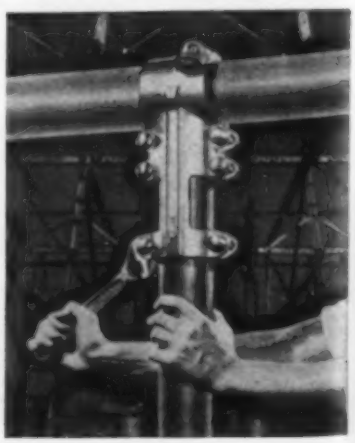
Cast steel steam trap

Printer-developer for 46 in. material

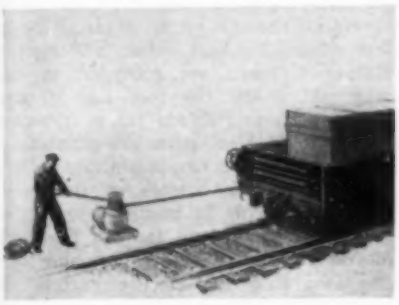


Suction device for container cleaning

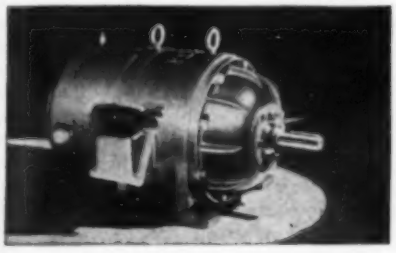
Cast alloy electrical connector



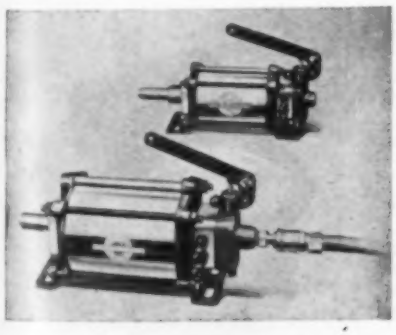
Light-weight portable pyrometer



Improved streamlined car puller



Motor for Class I, Group C atmospheres



Valve-controlled air cylinder

Midget dry air pump

West Congress St., Chicago 12, Ill., announces a new Reco control timer equipped with a synchronous motor. If desired, the timer can be equipped with interlocking controls so that each operation must be completed in correct sequence before the next is started. Failure at any point would post a signal and the timer would re-cycle automatically to the starting position. As an example of possible application, the timer can be used as a control for hydraulic presses, shutting off the pressure at a certain pressure value and holding the pressure for a predetermined time after the value is reached, after which the operator is signaled.

PORTABLE PYROMETER

WEIGHING only 1¾ lb., a new portable pyrometer offered by the Instrument Division of K. H. Huppert Co., 6830 Cottage Grove Ave., Chicago, Ill., is said to be particularly adapted to the reading of temperatures of hot gases or liquids or of molten non-ferrous metals. The body design of the new instrument elevates the scale to an angle offering maximum reading ease in all working positions, which also minimizes side reflections on the scale glass. The instrument is claimed to have an accuracy of 2 percent of the scale range. A variety of double-range scales may be had such as 0 to 500 deg. F. and 0 to 1,000 deg. F.; or 0 to 750 deg. F. and 0 to 1,500 deg. F. A zero adjustment screw for manual correction to room temperature is provided on the face of the meter.

CAR PULLER

KNOWN as the "one-man gang," a new Class 2½ Lo-Hed car puller has been announced by American Engineering Co., Philadelphia 25, Pa. In this device the barrel, gear box and motor are combined in a single streamlined unit. The starting line pull is 5,000 lb., using a single line, or more with various block combinations. In addition to its use in hauling and spotting freight cars, the puller has numerous other uses such as dragging logs and bending pipe.

IMPROVED VALVES

TWO NEW lines of valves, including cast steel globe and angle valves, and cast steel swing-check valves in 150 and 300 lb. pressure classes, have been announced by the Ohio Injector Co., Wadsworth, Ohio. The globe and angle valves are available with either spherical or plug-type disks and seats, in a number of trims, adapting them to fluid control in either full-flow or throttling service. The check valves are of the full-flow type in which the disk completely clears the fluid passage in the wide open position. The disk assembly is suspended from brackets inside the body and is removable as a unit through the cap opening.

EXPLOSION PROOF MOTOR

FOR USE in atmospheres containing ethyl ether and similar vapors, that is, Class I, Group C atmospheres, the General Electric Co.'s Motor Division, Schenectady, N. Y., has developed a new explosion proof motor available in frame sizes 204 to 326, in both normal and high starting torque types, for sizes from ½ hp. at 600 r.p.m. to 20 hp. at 3,600 r.p.m., for voltages of 110, 208, 220/440, and 550 and for 60, 50 and 25 cycles. The construction is essentially the same as that of the Class I, Group D motors, but a special flamepath is used at the shaft opening to control the flame of an internal explosion. Thermostats operate in conjunction with a magnetic controller to disconnect the motor at a predetermined temperature but do not supplant regular overload relays.

AIR CYLINDER

FOR THE operation of valves and dampers and for producing linear motion in various kinds of automatic machinery, the Bellows Co., Akron 10, Ohio, has introduced an air cylinder device developing a thrust of approximately 1,000 lb. force on an air line pressure of 100 lb. The new cylinder is similar to but develops more than twice the thrust of a similar device introduced about a year ago. The earlier device, known as the BM-5 air motor, develops a thrust of 4.9 times the operating pressure, while the new device, known as BM-10, develops 10.32 times the operating line pressure. These devices differ from conventional air cylinder design in that the valve and all operating controls are integral with the cylinder, permitting full and positive control over all operating phases at all times. Thrust may be had in either direction, with only one air connection to the unit, which may be by either flexible air hose or rigid piping. Independent feed control valves are provided to give precise and unlimited speed control of the piston rod advance and retraction.

DRY AIR PUMP

FOR USES where a small quantity of dry air is occasionally required. Andrew Co., Chicago 19, Ill., has developed a midget hand pump having an output of 3 cu. in. per stroke, equipped with a transparent plastic cylinder containing a drying agent which by its change from an initial blue color to pink indicates when the desiccant requires reactivation or replacement. The unit is only 6 in. long and 2 in. in diameter, weighing 10 ounces. It may readily be mounted on or behind an instrument panel.

EQUIPMENT BRIEFS

TEMPERATURES up to 1,800 deg. F. are said not to affect a new flame-proof metallic coating of high brilliancy, known as Blaze-Pruf Silver-Lume, which has recently been introduced by the Wilbur & Williams Co., 1036 Park Square Bldg., Boston 16, Mass. In addition to its use at high temperatures the coating is said to be suitable for coating cold surfaces which require a non-flammable fire-resistant coating. The material may be applied to glowing metal surfaces without flame hazard. It may be used either on wood, masonry or on metal and in the

case of the latter is claimed to penetrate rusted and pitted surfaces to form a seal against further corrosive action.

FANWELD is the name of a new nonferrous hard-surfacing metal that has been put on the market by Fansteel Metallurgical Corp., North Chicago, Ill. The metal is intended for acetylene torch application to steel and is claimed to possess marked resistance to abrasion, heat, impact and erosion. It contains tantalum-columbium carbide which imparts a peculiar self-lubrication so as to minimize destructive effects of friction, even at elevated temperatures. When properly applied the metal wets the steel surface without a flux. Hardening and heat treatment are unnecessary.

THROUGH the use of a new power booster designated as Model HP-16, developed by the Talk-A-Phone Mfg. Co., 1512 South Pulaski Rd., Chicago 23, Ill., it is claimed that the regular plant intercommunication system can become a paging system, enabling the executive to be in touch with his plant as well as his office, without the need for going through the central switchboard. When employed with certain of the company's inter-communication systems the new booster becomes an integral part of the system. It is merely necessary to press a button to allow the voice to go out into the factory, penetrating high noise levels.

SEVERAL improvements have been announced in various packings by Greene, Tweed & Co., Bronx Blvd. at 238th St., New York 66, N. Y. Palmetto Plaited Packing is a new general service packing for centrifugal pumps which uses long-fiber asbestos instead of cotton, enabling the packing to be used for hot as well as cold water. This packing is also recommended by the maker for reciprocating pump rods and plungers, and for valves and hydrants on hot or cold water service. A second development is a new flax packing intended primarily for use with hydraulic plungers. It is claimed that in the past, flax packing has tended to harden prematurely, owing to the custom of plaiting the flax dry, before lubricating. The new process lubricates each strand before plaiting and is said to insure thorough penetration and impregnation. Two types are available, the regular tallow-impregnated type and also a graphite coated packing.

GENERAL-PURPOSE welding of mild steel in all positions is the function of the new Fleetweld 47 coated electrodes for shielded arc welding recently announced by Lincoln Electric Co., Cleveland 1, Ohio. The new electrode is claimed to offer several improvements, including low spatter loss, easy slag removal (most welds are said to be practically self-cleaning), and excellent re-striking characteristics. The electrode is used with either direct or alternating current.

FOR USE in hydraulic de-barking of logs in the paper industry, the United States Rubber Co., Rockefeller Center, New York, N. Y., has developed a flexible hydraulic hose capable of carrying a stream of water powerful enough to strip the bark from a 20 ft. log in 30 sec. Savings of 18 to 20 percent in pulp and 20 percent in manpower have been reported on the Pacific Coast for hydraulic de-barking. In this process two jets of water spurt from nozzles on a mobile carriage and so great is the pressure that the nozzles must be kept moving constantly to prevent the water from boring a hole through the log at the point where it strikes.

TYPE E is the designation of a new line of Dodge-Timken bearings made in both pillow block and flanged units by the Dodge Mfg. Corp., Mishawaka, Ind. These units are designed to give low-cost satisfactory performance under normal service conditions. They are provided with labyrinth seals to prevent loss of lubricant and protect the bearing against damage from dust, dirt or moisture. Bearings are completely assembled, lubricated and adjusted at the factory. While not fully self-aligning, they have enough self-alignment inherent in the design and arrangement of the rollers to compensate for normal misalignment.

NEW ACID HOOD

PROTECTION to chemical workers against all concentrations of nitric, sulphuric, hydrochloric acetic, hydrofluoric and carbolic acids is afforded by a new acid hood recently introduced by the Chicago Eye Shield Co., 2300 Warren Blvd., Chicago 12, Ill. The hood, worn over the head, shoulders, chest and back, and snugly tied about the waist, is made of Cesco Acitex and is provided with a clear window to give normal vision. An air-feed unit and side vents for air circulation are said to insure comfort. The vents are splash-proof.

HAND TACHOMETER

COMPACTNESS, combined with high accuracy, is claimed for the new portable electric tachometer, Model 5-E, manufactured by Chicago Electric Tachometer Co., 800 North Clark St., Chicago 10, Ill. Owing to the small size of the instrument, it can be operated in close quarters.

Protective hood for acid workers

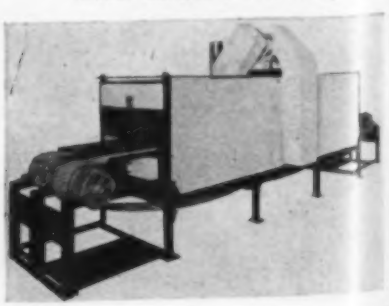
Available with a double-range scale, the scale is changed simply by pressing a button on the side of the instrument. If desired, a wheel may be substituted for the rubber shaft tip when it is necessary to measure surface speed.

CONVEYOR TYPE OVEN

VERSATILITY of use is claimed for a new continuous heat-processing oven featuring a double conveyor belt which has been designed and built by the Gehnrich Oven Division of W. S. Rockwell Co., 50 Church St., New York 7, N. Y. The oven housing is built of this company's patented insulated dual-panel assembly, having no through metal or metal joints, thus minimizing heat losses. The electric heating elements are mounted in the oven just below the roof and a large motor-driven multi-blade fan is mounted on the roof. Heat from the elements is drawn through the fan, blown into a vertical duct at the bottom of the oven, distributed evenly by means of louvers in the oven floor upward through the work moving on the conveyor belts, and then flows up past the electric heaters. If gas or steam heating is desired, the heater and fan unit can be set on the roof, with the same means of heat distribution and recirculation. The wire-mesh conveyor belts are individually driven through variable speed drives permitting operation of the conveyors at any desired speed in the same or opposite directions. The oven can be provided with suitable ventilation means for purging volatiles. It is equipped with interlocked automatic protective controls of temperature, heat source and fan to assure positive operating safety and uniformity of processing conditions.

Portable electric tachometer

Double conveyor electric oven



Thank you, Mr. Lavoisier!

If we could travel back through time a hundred and fifty-one years, we would like to shake hands with Antoine Laurent Lavoisier. Contrary to contemporary belief in a mystic "phlogiston" of "negative weight," this early French scientist proved gas to be genuine substance with tangible, workable mass and weight. Thereby he laid the foundation for today's industrial gas processes.

Since Lavoisier, gas processing has become a major industry. Especially during recent decades, developments have succeeded developments in a way that can be assimilated only by men who make gas processing their particular professional interests. When in need of new or improved gas processing facilities, it pays to call upon the Girdler organization of gas processing SPECIALISTS.

Girdler offers processes for gas manufacture, purification, separation, and dehydration. Consult us on your problems concerning hydrogen sulphide, carbon monoxide, carbon dioxide, natural gas, refinery gases, liquid hydrocarbons, hydrogen, nitrogen. Originators of the Girbotol Process.

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Recovery of Grain Alcohol Byproducts

A SYSTEM which recovers as valuable feed byproducts 100 percent of the stillage from grain alcohol production has been developed by Hiram Walker & Sons, Inc., at its Peoria, Ill., plant. Grain alcohol stillage was formerly a nuisance, and its treatment was a waste disposal problem. Now, however, its treatment is one of recovering valuable byproducts in the form of distillers' dried grains with solubles, used in dairy cattle feeding, and distillers' dried solubles, a high-vitamin feed supplement used extensively in poultry and swine feedings. A recovery of 17-18 lb. (depending on the grains used) of grain byproducts is obtained from each bushel of grain mashed. The entire process is an excellent example of the conversion of a nuisance waste material into valuable byproducts by the application of chemical engineering principles.

Hot stillage, containing 5-7 percent total solids, depending on the grain used and mashing concentration, is pumped directly from the base of the stills over screens equipped with moving wood paddles. The wet screenings, at about 85 percent moisture, are pressed in revolving type presses to a moisture content of about 70 percent. The screen effluent is centrifuged (a patented process) in solid basket batch centrifugals, and the clarified fraction is evaporated in multiple-effect evaporators, consisting of two sets of triples and a finishing pan, to a concentration of 35-40 percent solids.

The wet screenings, the wet solids from the centrifuges, the major portion of the concentrated syrup, and recirculated dried grains are mixed and dried in rotary steam tube dryers to yield distillers' dried grains with solubles. Previously dried material is recirculated in order to maintain a constant moisture content feed to the dryers. The product is cooled and loaded into box cars in bulk by a blower system or sacked in burlap bags.

A portion of the concentrated syrup is shipped out in barrels as distillers' semi-solids. The remainder is dried on double drum dryers to yield distillers' dried solubles. This latter product contains relatively high concentrations of the water soluble B-vitamins, from the grains and from synthesis by the yeast during the alcohol fermentation.

CHEMICAL & METALLURGICAL ENGINEERING

June 1945

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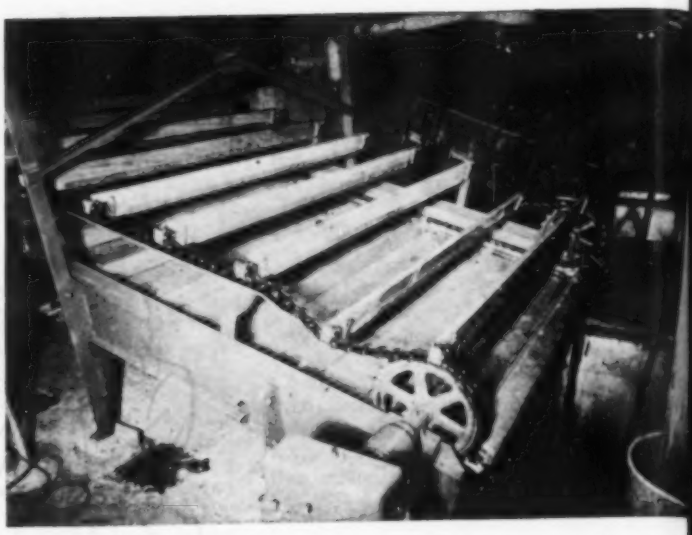
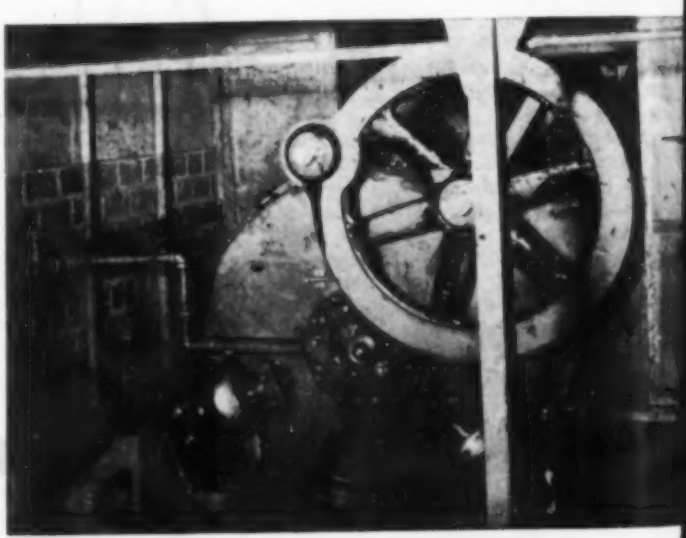
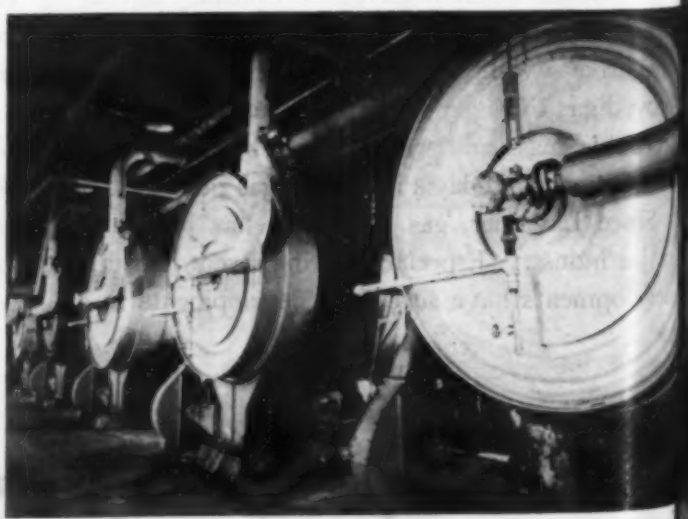


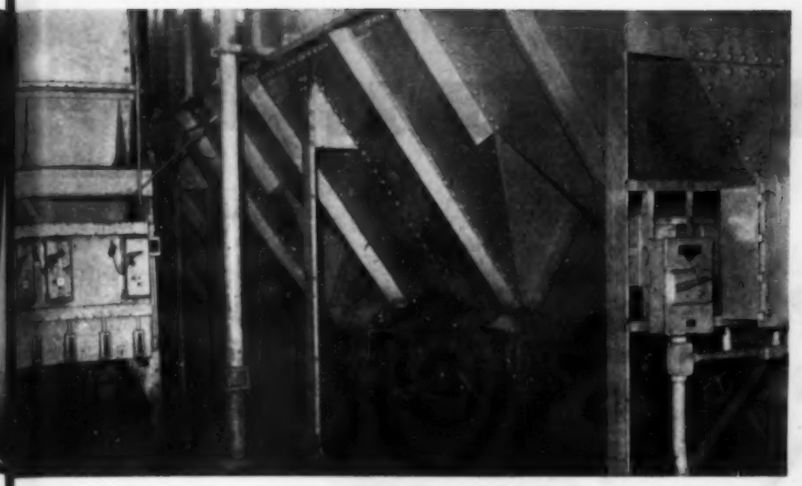
1 Hot stillage (spent grain from stills) is pumped directly fr the base of the stills over paddle screens



2 The screenings are pressed in revolving presses to reduce moisture content from 85 percent to 70 percent



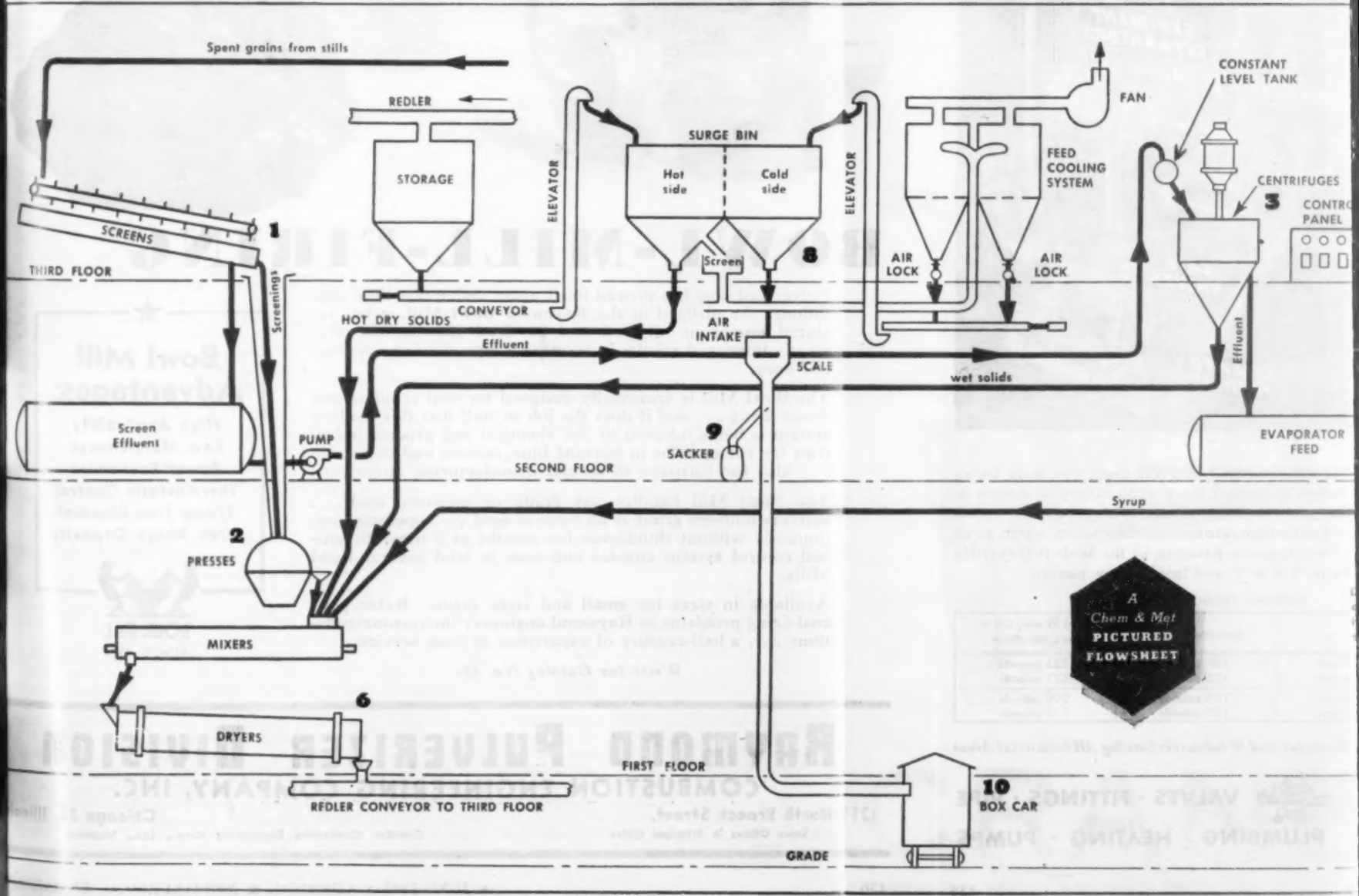
6 A battery of rotary steam tube dryers for drying certain terials to yield distillers' dried grains with solubles



8 A surge bin system keeps operations in balance in recovery as valuable feed products 100 percent of the stillage from grain alcohol production

9 Finished product may be packed in burlap, or water-proof paper bags, or sacks for shipment

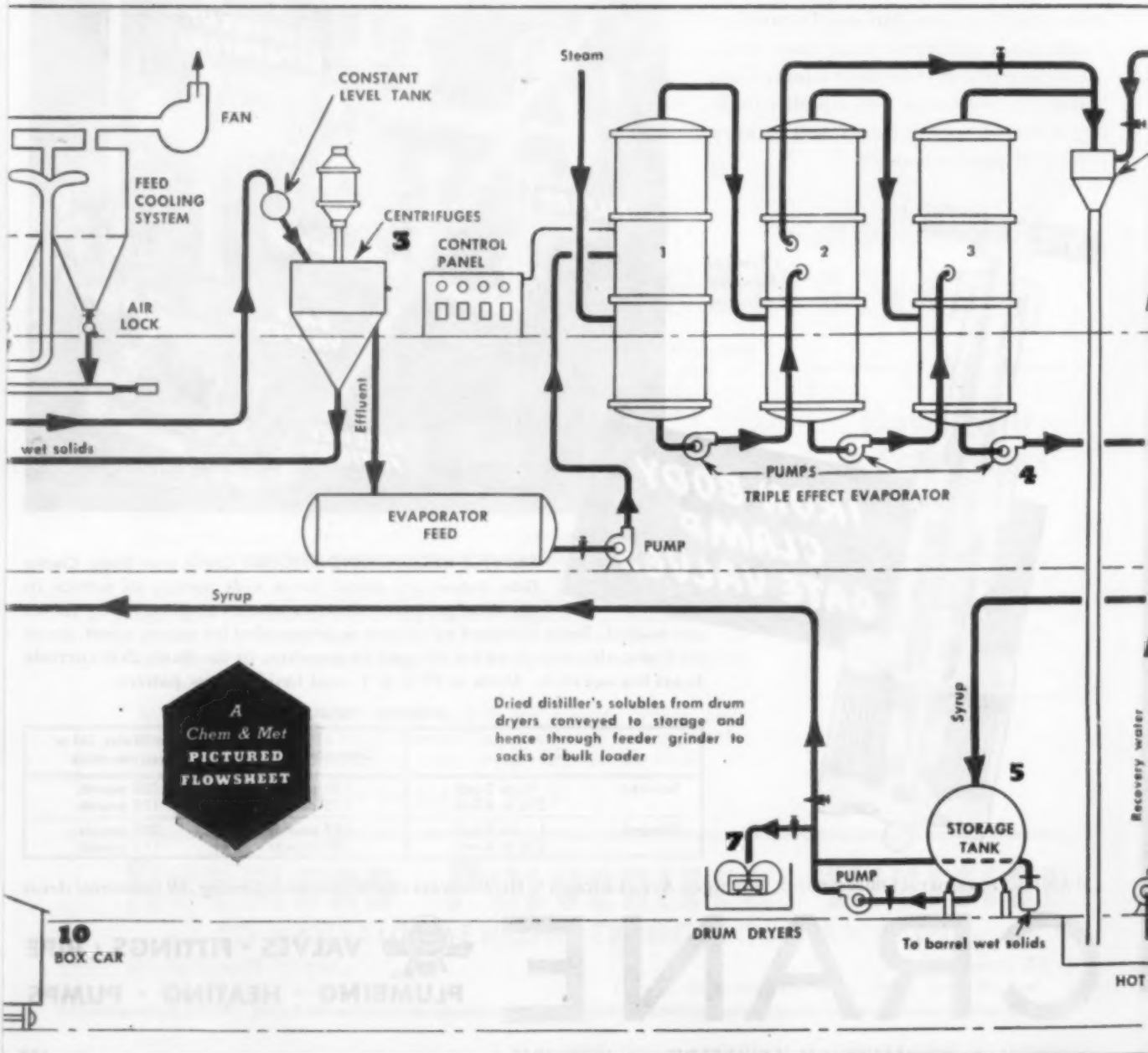
10 Part of loaded in gra



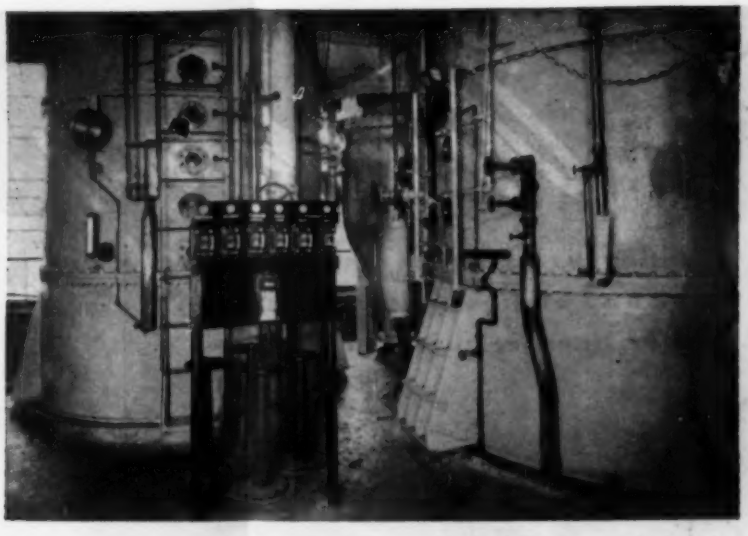
in burlap, or water-proof paper

10 Part of finished product is bulk loaded in grain cars by means of air

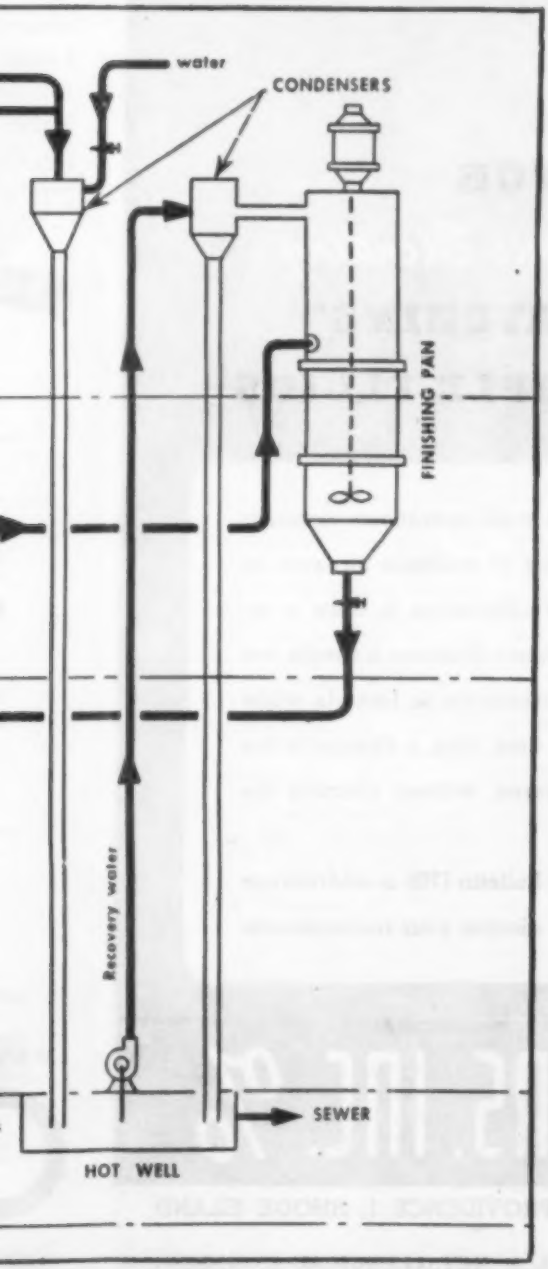
3 The effluent from the paddle sc pumped to basket centrifugals

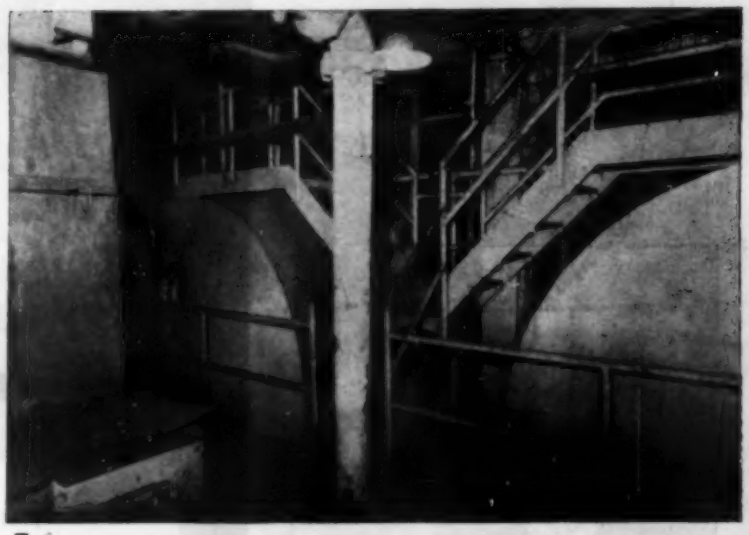


e paddle screens passes to storage tanks and then is
ifugals

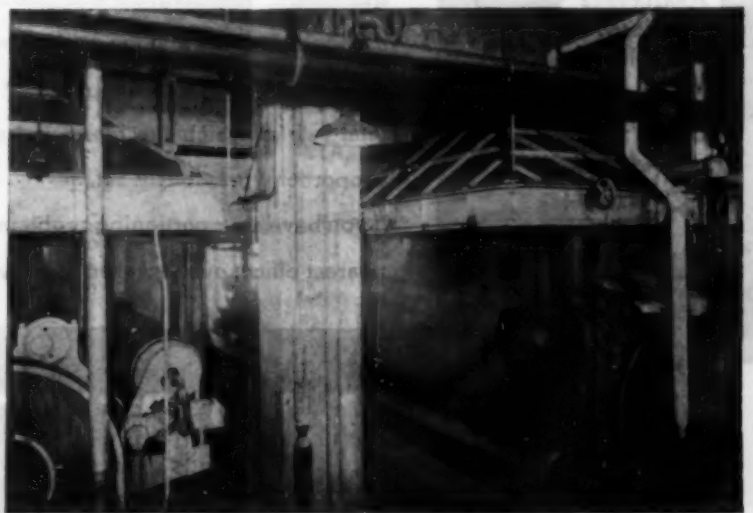


4 Clarified thin stillage from the centrifugals is evaporated to 35-40 percent solids in a multiple-effect evaporator system



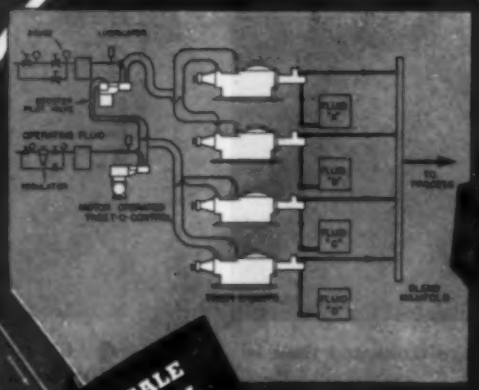


5 Concentrated syrup from multiple-effect is stored in these tanks, later to be pumped to drum dryers and mixers



7 The remainder of the concentrated syrup is dried on rotary double-drum dryers to yield distillers' dried solubles

Working PRINCIPLES



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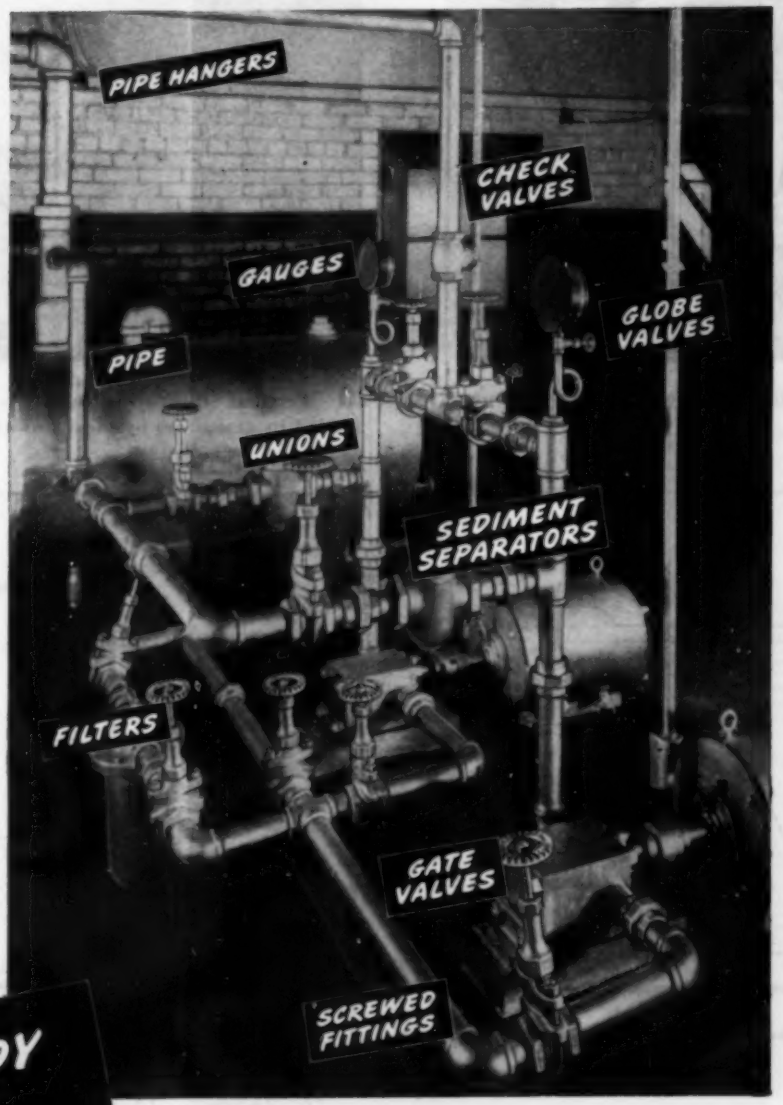

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	2½ to 4-inch	125 pounds	175 pounds
Flanged	1 to 2-inch	125 pounds	200 pounds
	2½ to 4-inch	125 pounds	175 pounds

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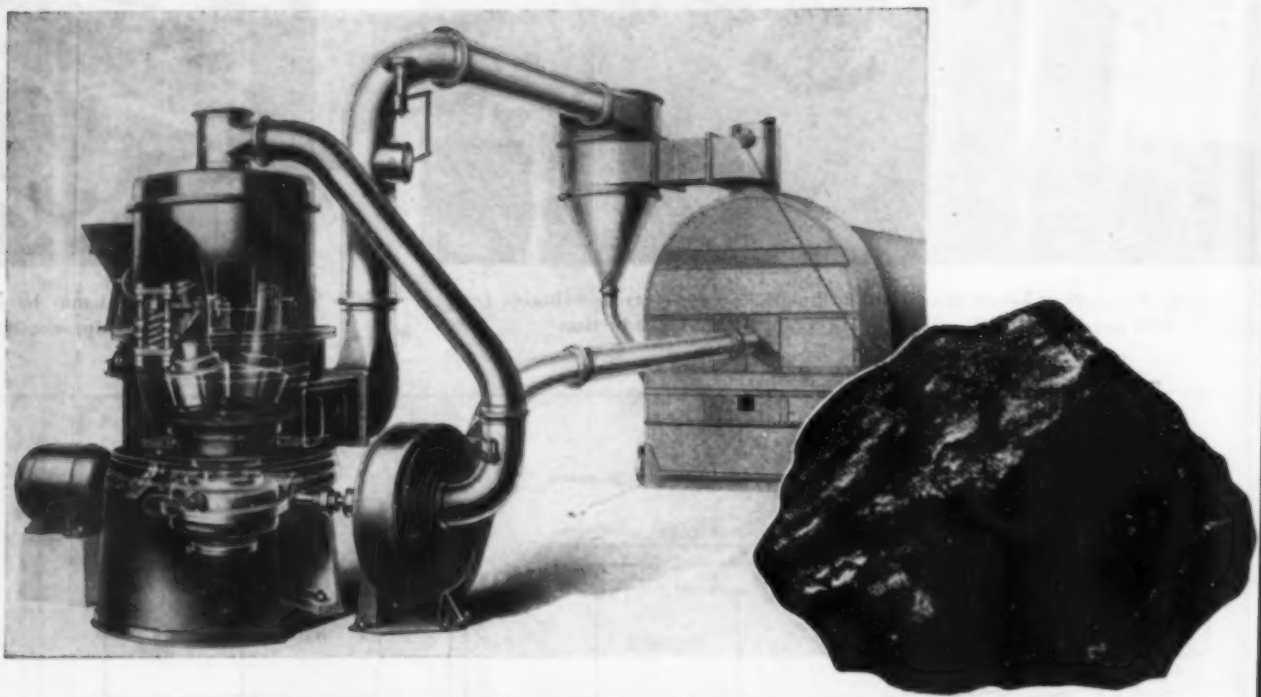

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The Bowl Mill handles any grade or moisture coal . . . delivers uniform grind at all rates of feed . . . operates continuously without shutdowns for months at a time. Simplified control system enables one man to tend several Bowl Mills.

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NEW PRODUCTS AND MATERIALS

JAMES A. LEE, Managing Editor

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ALUMINUM METAPHOSPHATE

From aluminum metaphosphate can be manufactured a kind of glass which transmits a substantially greater amount of ultraviolet light and its accompanying vitamin D. Postwar fluorescent lights may utilize phosphate glass for its ultraviolet permeability and it may also be found useful in window panes of hospitals and solariums. With the addition of FeO to absorb infrared rays, the glass can be used as a heat screen for projectors or other optical lenses. Phosphate glass is markedly superior to ordinary glass in point of corrosion resistance and may therefore find use in window panes exposed to corrosive atmosphere and in corrosion-resistant reagent bottles, particularly HF containers. As electrical insulators, the glass shows unusually low current loss.

With all this in mind, it is interesting to note that the raw material from which this superior glass is manufactured, aluminum metaphosphate, has been scheduled definitely for volume production in the postwar era by the Monsanto Chemical Co., St. Louis, Mo. Although aluminum metaphosphate has a relatively high melting point, it can be melted into a clear glass without undue difficulty. Fusibility and meltability can be greatly improved by small additions of various common oxide or fluoride fluxes. Silica can be incorporated up to 30 percent by weight, though this sacrifices somewhat the very low coefficient of thermal expansion found in phosphate glasses. However, even with large additions of silica, glasses with coefficients in the order of Pyrex glass can be produced.

If desired, the transmission of infrared rays can be materially reduced by the addition of about 2 percent FeO. A glass which will absorb both ultraviolet and infrared rays can be prepared by the addition of FeO and Fe_2O_3 in a total amount of about 2 percent.

RUBBER CEMENT

A new solvent adhesive having a synthetic rubber base and "matching rubber cement quality for quality" is being produced in commercial quantities by the Union Bay State Chemical Co., Cambridge, Mass. The adhesive is known as Ubapol and is said to provide all the features formerly found in prewar rubber cement—retack, flow, break, rub-off, and non-penetration.

Ubapol is now available in reasonable quantities (several thousand gallons per month per customer) without priorities. It has been tested as a labeling adhesive and provides a satisfactory bond on fiber board, wood, black iron, and galvanized iron. It has also been used successfully for sealing the L-2 liners which are standard packaging material for export shipment.

In general, it can be said that Ubapol works best in the assembly industries where a bond is desired on paper, leather or fabric. It is also being used satisfactorily in the shoe industry and in related industries manufacturing such articles as pocketbooks, handbags, and athletic goods.

RESIN-COATED FABRIC

The idea of a coated fabric is not new. The "oilskins" worn by old-time sailors were made of a fabric treated with linseed oil, and rubber-treated fabrics have long been popular, especially for raincoats. But when, at the start of the war, the Japanese cut our rubber supply from the Far East, there was no more rubber for raincoats and the whole American chemical industry set to work to find a substitute—so-called, at the time—for natural and synthetic rubber used as fabric coatings. As a result, there is now a wild profusion of resin-coated fabrics being offered for the postwar market. There are many manufacturers and many trade names—and hardly any limit to the kind of fabric or the kind of resin coating which can be obtained.

Recently the Du Pont Co., Wilmington, Del., announced that it too will have a line of coated fabrics, which it will market under the trade mark, Fabrilite. Different coatings will be applied to different fabrics, but if the finished fabric falls into the light-weight, special-purpose, synthetic resin-coated class, it will be known as Fabrilite. During the war, Du Pont's Fabrilite, of one kind or another, has served as rainroats, mountain tents, ponchos, jungle hammock canopies, life-raft sails, and paulins.

The material is light, tough, flexible, washable; it resists cracking, stretching and shrinking; it is serviceable at zero temperatures and it is proof against water, cold, wind, dust, perspiration, moths, and food chemicals. It may be stitched on a sewing machine like ordinary cloth, or it may be cemented or sealed by heat.

CORROSION PREVENTIVE LUBRICANTS

One of the difficult jobs in this war has been the protection of instruments, gun mechanisms, and finely finished parts against the rigors of overseas shipment and long periods of exposed storage. Adding to the difficulty is the fact that most precision items must be delivered in immediately usable condition. A number of ingenious packaging techniques have been evolved which amply protect parts from outside damage, while inside protection is furnished usually by special lubricants. Among the latter is the Stanorust series of corrosion preventive lubricants developed during the war by the Standard Oil Co. (Ind.), Chicago, Ill.

Stanorust lubricants are water-resistant, non-corrosive to metals, non-gumming, have low viscosity at low temperatures, and are stable against oxidation during storage. They are made from selected mineral oils, with lubricating and corrosion-preventive additives.

The prime purpose of Stanorust, or any lubricant of this class, is to prevent corrosion and at the same time provide lubrication of a quality which permits the operation of close-fitting parts at low temperatures. Without it, instruments, small arms and machine guns freeze or become sluggish in action on cold fronts or in high-altitude planes. Shipments of parts treated with these materials are available for use immediately after being taken from the package. In the last war, each piece required a lengthy cleaning.

Stanorust is commercially available in several grades to conform to Army Specifications AXS-702, 2-122, and 2-120.

THERMOPLASTIC INSULATOR

In the fabrication of electronic devices such as radar, television, and facsimile transmitters, it is highly desirable to make some parts of the equipment out of plastic insulating materials. Electronic researchers have long had at their command a rigid plastic with good insulating qualities, but this material, unfortunately, starts to lose its shape at 168 deg. F. Certain ceramics and glasses are ideal as insulators and retain their shape at high temperature, but they cannot be precision-molded or machined.

All of these shortcomings which are evident in conventional insulating materials are said to have been eliminated in a new thermoplastic, Styramic HT, re-

cently put in volume production by the Monsanto Chemical Co., St. Louis, Mo. Styramic HT has the three requisites which make it admirable for use in constructing electronic equipment. First, it is a good electrical insulator. Second, it can be molded with precision and economy. And, third, it has a heat distortion point of 236 deg. F. (as against 168 deg. for its predecessor).

Styramic HT is being produced at Springfield, Mass., in a new DPC plant designed and operated by Monsanto. The entire output is channeled into highly classified military requirements and there it little likelihood, Monsanto says, that even small quantities can be immediately distributed to plastic manufacturers for evaluation in other than war products. Complexity of manufacture and low yields from raw materials will keep the price up even in the immediate postwar, so that Styramic HT is being projected as a specialty product where performance rather than price is the dominant factor.

FIBERGLAS MAT

THIN, porous mats of bonded glass fibers, originally developed for use as retainer mats in storage batteries, and widely employed for this purpose, have now been successfully applied to a number of entirely new uses by the process and electrical industries.

In roll form, the mat is being employed as a material for wrapping underground oil, gas and other pipelines to protect them against corrosion and electrolytic action. The material can be wrapped around bitumen or coal tar-coated pipe, thus forming a continuous water-tight bond. The millions of fine intertwined glass fibers reinforce a large amount of coating for a given thickness of wrapping, as compared to other carriers.

Fiberglas mats are also being utilized as the base for a new plastic laminated material, primarily because of the high tensile strength and non-hygroscopic characteristics of the individual glass fibers. Possessing a low and stable loss factor over a wide frequency range, the laminate greatly extends the field for plastic coil forms, condenser spacers, stand-off insulators, etc., in radio, television and other high-frequency electronic devices. In building up the laminate the Fiberglas mats are impregnated with a thermosetting aniline-formaldehyde resin and are cured under high pressure. In addition to its low loss factor, the laminate possesses high strength, high temperature resistance, dimensional stability, and resistance to fungus attack. Good machinability is another property of the laminate.

A third new use for the mat is as a base material for gaskets and sheet packing. The mat acts as a carrying medium for synthetic resins suitable for applications requiring resistance to heat, oil and acids. Glass-base gaskets now being manufactured show high pressure resistance, good chemical durability, and little flow under flange pressure.

Made by Owens-Corning Fiberglas Corp., Toledo, Ohio, Fiberglas mat is composed of fine glass fibers intertwined in random orientation and bonded together to form a thin, highly porous felt-like material. Several types of binder (starch, gelatin, furfural, phenolic) may be used, depending upon the requirements of the end use. Mats are produced in thicknesses ranging from 10 to 50 one-thousandths of an inch; standard widths of 22 and 36 in.; roll lengths of 150 and 300 ft.

ABSORBENT MATERIAL

THE PURPOSE of a new mineral product, Super-Absorbit, is to act as a blotter for spilled liquids. It comes in pulverized form and is scattered about on the floor or any other surface (it is claimed to be non-abrasive) where oil, grease, water, sirup, acid or other chemicals are likely to be spilled. Super-Absorbit will absorb over three times its weight in oil and almost four times its weight in water.

Since it does not become slippery or mat when saturated, it makes for safety and easy sweep-up. Fireproof, dielectric, and very light in weight, the new product is claimed by its manufacturer, the Alexite Engineering Co., Colorado Springs, Colo., to be one of the most economical fireproof absorbent materials available.

METAL CLEANER

A "PICKLING" agent to remove rust, scale, tarnish and incrustations of cement and lime from metals is being marketed by Waverly Petroleum Products Co., Philadelphia, Pa., under the trade name, Troxide. It is a dry, inert compound, and is non-eruptive, non-flammable, and allegedly presents none of the occupational hazards common to acids heretofore used in pickling.

It is claimed that Troxide, unlike conventional acid pickling solutions, throws off no "acid mist" or other toxic fumes which may be corrosive or harmful to workmen and machinery. Troxide attacks scale, but not sound metal, and leaves a smooth, bright surface. It may be used either hot or cold, and is said to last many times longer than the usual acid solutions.

MOTOR OIL ADDITIVE

TO IMPROVE the performance of solvent-extracted or conventionally refined motor oils so as to give maximum engine cleanliness under severe service; to reduce oxidation, varnish formation, ring sticking, filter deposits, and bearing corrosion; and particularly, to improve the oils to the point where they will meet such tests as those included in Army Specification 2-104B—the Standard Oil Co. (Ind.) has developed an additive which it calls Stan-Add 44. It is said to act as a detergent, an oxidation inhibitor, and a corrosion inhibitor, and is used to the extent of 2.5-3.75 percent, depending on the quality of the base oil.

Stan-Add 44 is a viscous, oily liquid with a slight odor which is barely perceptible in the final compounded oil. Its viscosity index is 104-107, and the principal ingredient is a selected petroleum derivative, with potassium as the metallic constituent responsible for detergency. In addition to the qualities already enumerated, Stan-Add 44 is claimed to be the only additive which improves the viscosity index of the finished oil instead of reducing it. Ash content is low compared with other additives, and anti-rust properties are excellent. Sufficient anti-foam agent is included to prevent foaming of the finished oil under any conditions.

Stan-Add 44 is being used by Standard of Indiana to make Stanolube HD and is the improved version of a very similar previous additive used for the same purposes. Stanolube HD has been used in every type of Army ground equipment and has given good performance in many billions of miles of severe heavy-duty operations.

The additive is available in tank car quantities and does not use any critical materials. It is being supplied to a number of other manufacturers of heavy-duty oils.

FLAMEPROOFER

LUMBER, textiles, and all porous materials can be rendered "fireproof" by application of a modified phosphor-alum called "Pal," according to Leslie L. Linick, Chicago, Ill., manufacturers of the chemical. Pal is a crystalline powder, non-toxic, and soluble in water. It is used as a water solution which penetrates quickly and does not cause stiffening or hardening when applied to fabrics.

About one pound of the chemical is used per gallon of hot water and articles may be sprayed, dipped or brushed. Already used for fireproofing work-clothes, molders' cotton gloves, stockings, mattresses, parachutes and similar articles, Pal solution has been found to have no harmful effect on any material which is not affected by warm water.

ALKYL BROMIDES

NORMAL-hexyl, -octyl, and -decyl bromides are now available for research and manufacturing purposes from Halogen & Perfume Chemicals, Columbia, S. C. These three bromides are produced from the corresponding alcohols with sodium bromide and sulphuric acid, and are clear, water-white, pleasing in odor, and valuable as intermediates in many organic reactions. Special precautions are taken in purification to render the final product as free as possible from alcohol and, therefore, to make the halide especially suitable for processes hindered by the presence of alcohols.

LINSEED VARNISH OIL

SPONTANEOUS polymerization, low acid value, and improved quality are the advantages claimed for a new linseed varnish oil recently announced by Spencer Kellogg and Sons, Buffalo, N. Y. Ordinary linseed varnish oils, depending upon the origin of the flaxseed, may be bodied to a Z-5 viscosity (Gardner-Holdt Scale) at a temperature of 590 deg. F. in from five to seven hours. So-called fast bodying linseed varnish oils have subsequently reduced the necessary time from 35 to 40 percent. The new product, which will be marketed under the trade name Kelvitol, polymerizes in such a short time that it can be regarded as spontaneous.

A number of production cooks have been made in two-drum open units with

No Metal need touch your product

PFAUDLER GLASS-LINED VALVES, PIPE, FITTINGS

Protect against acid corrosion every inch of the way

PFAUDLER Glass-Lined Valves, Pipe and Fittings, Heat Exchangers together with Pfaudler Glass-Lined Reaction Kettles now permit you to conduct every step of your process in the total absence of metal. Here is complete protection against corrosion and a safeguard against product contamination from metal pickup.

Pfaudler Glass-Lined Valves

Pfaudler Glass-Lined Flanged pipe is made of high quality low carbon steel tubing, lined with Pfaudler highly acid resisting glass which is carried to outer edges of all flanges. Made in 1½" diam. up.

Fittings are of high quality cast iron, glass-lined; available in straight and reducing types including elbows, tees, split flanges, crosses and straight reducers. Standard pipe and fittings are designed for 125 p.s.i.; high pressure pipe and fittings for 300 p.s.i.

Pfaudler Glass-Lined Pipe and Fittings

Pfaudler Glass-Lined Valves are available in standard flush, pop and line types and in 1½", 2" and 3" sizes. Cast iron bodies are glass-lined and valve seats are of porcelain. Valve head is carried on a glass covered stem that cannot break under tension. Reseating is quickly and easily done without dismantling and without special tools. Merely turning lower grinding wheel back and forth lightly restores original seat.

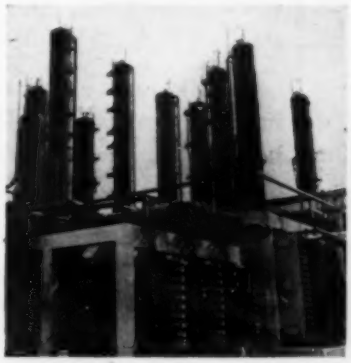
Another feature of these Pfaudler Valves is that one valve body is used for all types so that conversion from a flush valve to a globe, throttle, line or pop safety valve can be made by merely changing operating mechanism and porcelain parts. Complete description and specifications in Bulletin 544.

Pfaudler Glass-Lined Heat Exchangers

Pfaudler Glass-Lined jacketed pipe connected in parallel by 180° glass-lined return bends bolted to the pipe and using lead shrouded asbestos gaskets are proving durable, efficient heat exchangers. This double pipe or hairpin design provides extreme flexibility. A wide range of heat transfer surface is obtainable with various series or parallel arrangements of this piping for heaters, coolers and condensers. Sections may be added, removed or rearranged to suit particular process conditions.

Unjacketed glass-lined pipe connected in the same manner is being widely used as coolers, with cooling water cascading down the outside.

Complete description and specifications of Pfaudler Glass-Lined Pipe and Fittings in Bulletin 829 and "The Glass Lining," Vol. 15, No. 2.



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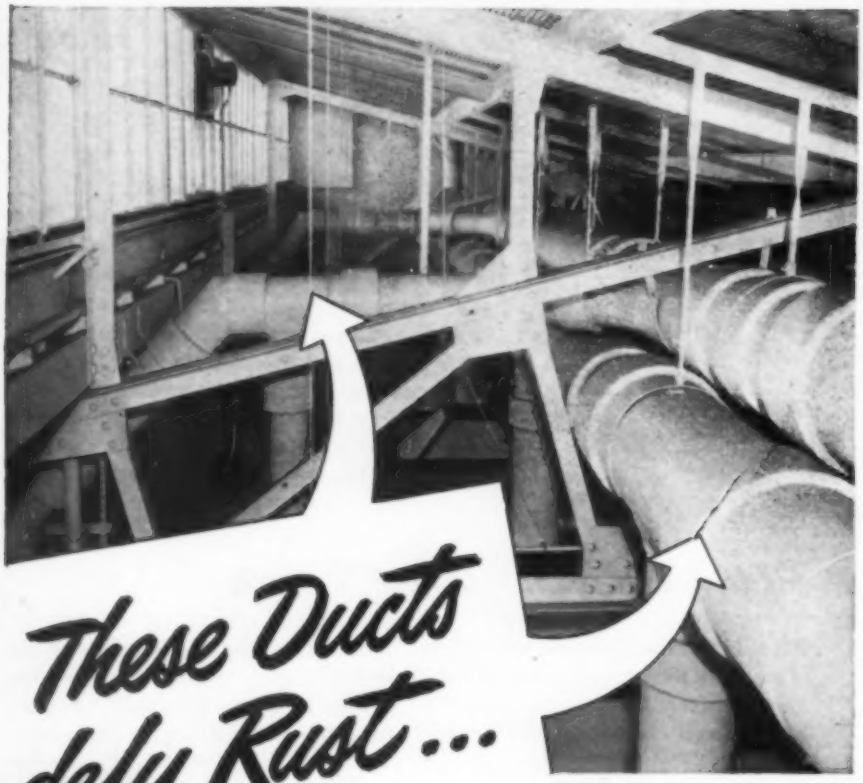

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withstand Corrosion by many industrial fumes, vapors, gases

DO RUST AND CORROSION play havoc with your venting system? Many users are finding that Johns-Manville Transite "S" Pipe offers a practical answer to this problem. Made of asbestos and cement, it is completely rustproof . . . successfully resists many types of corrosion encountered in industrial venting systems.

Rotproof and highly weather-resistant, Transite "S" Pipe can be used either indoors or outdoors—for ducts, vents and stacks—without painting or other surface protection.

Installations, such as the one shown, present no problem because Transite "S" Pipe is light in weight, easily assembled, and comes in a range of 19 sizes—diameters from 2" up to 36". A complete line of fittings is also available.

For full information, write for data sheets DS Series 336. Address Johns-Manville, 22 East 40th Street, New York 16, New York.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE 'S' PIPE

interesting results. Kelvitol heated to 585 deg. F. and removed from the fire rose to 605 deg. F. and upon cooling had acquired a Z-5 viscosity body without further heating. In another test the oil was pulled from the fire at 580 deg. F., the temperature rose to between 590 and 595 deg. F. and with very little further heating had acquired a Z-5 body. (Regular varnish oil at this low temperature would ordinarily require over eight hours cooking to acquire the same body.)

Kelvitol has a light color and approximately half the acid value of similar oils with long cooks, plus improved waterproofness of film. The acid value of Kelvitol at a Z-5 body is approximately eight. It polymerizes in approximately 20 percent of the time required for regular linseed varnish oil. Although wartime conditions control the output of this new product, the manufacturers will distribute test quantities to organizations in the protective coatings field.

ALL-PURPOSE ADHESIVE

"BONDS Anything to Anything" is the claim made for a new adhesive, Pliobond, manufactured by Goodyear Tire & Rubber Co., Akron, Ohio, and marketed by U. S. Plywood Corp., New York, N. Y. Metals, plastics, fabrics, ceramic ware, vulcanized rubber, paper, leather, glass, plaster, wood, and portland cement concrete—all can be firmly adhered either to themselves or to each other. Application can be made either as a cold-setting cement or under heat and pressure, depending upon requirements. In general, the strength of bond obtained with heat and pressure is superior to that obtained at room temperature. However, in many cases the room temperature bond will exceed the strength of the materials being bonded.

There are a number of important properties of Pliobond which greatly enhance the usefulness it already possesses by virtue of its "universal" qualities. The most important of these are: durability, flexibility, ease of application.

Durability is indcated by the fact that aging tests, such as those used on rubber, show little loss of the high initial bond strength over a long period of time. The bond is highly resistant to moisture and is sufficiently waterproof, it is claimed, to permit laundering of glued fabrics. Continued immersion in water will reduce bond strength, but this is fully restored on drying. It is resistant to dilute acids and alkalis and to carbon tetrachloride, ethylene glycol, alcohol, gasoline and other petroleum distillates. It is also immune to attack by mildew and fungi.

However, there are two conditions which adversely affect bond strength. These are high temperature and sustained stress. Since it is a thermoplastic and undergoes cold flow, Pliobond will creep and fail prematurely under constant load. For example, a sustained load of 200 psi. in shear will cause failure of an aluminum-to-aluminum bond in about 200 hr. at a temperature of 75 deg. F. As to the effect of temperature, the instantaneous shear strength of a freshly bonded lap joint is only 25 percent as great at 150 as at 75 deg. F.

The high degree of flexibility of Plio-

efficient plasticizer available at low price

Immediate Shipment . . . No Priority Needed

If you need an efficient plasticizer *now* . . . one that is low in price . . . Monsanto Ortho-Nitrodiphenyl is your answer. It can be shipped at once, without priority, in quantities up to carloads.

As a plasticizer, Monsanto Ortho-Nitrodiphenyl has a wide range of applications. It may be used alone or in conjunction with other plasticizers and is applicable to the entire range of synthetic resins from the cellulose esters and ethers through the vinyls and vinyl copolymers. It is compatible with alkyds and some synthetic rubbers.

A brief review of Monsanto Ortho-Nitrodiphenyl is presented here. If you want further information and a sample of the plasticizer, they will be sent promptly upon request. Please contact the nearest Monsanto office, use the coupon below or write: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Seattle, Montreal, Toronto.

* *Technical Grade. Refined grade, 10c per pound in carlots.*

ORTHO-NITRODIPHENYL DATA

The figures included are approximately correct and can be considered as average values for regular production of Ortho-Nitrodiphenyl, Technical.

MELTING POINT	35°C.
BOILING POINT AT 10 MM.	172°C.
BOILING POINT AT 760 MM.	320–330°C.
REFRACTIVE INDEX AT 25°C.	1.6128
SPECIFIC GRAVITY AT 40°/15.5°C.	1.189
SPECIFIC GRAVITY TEMPERATURE COEFFICIENT	0.00083/°C. (33°-80°C.)
VISCOSITY AT 25°C. AT 45°C.	38 Centipoises 12 Centipoises
FLASH POINT	143°C. (289.5°F.)
FIRE POINT	179°C. (354.5°F.)

SOLUBILITY: Ortho-Nitrodiphenyl is readily soluble in most organic solvents but is practically insoluble in water, either hot or cold. Some of the materials in which Ortho-Nitrodiphenyl will dissolve are:

Benzene	Ethyl Acetate	Mineral Spirits
Ethyl Alcohol	Amyl Acetate	Pine Oil
Methyl Alcohol	Ortho-Dichlorobenzene	Turpentine
Ether	Carbon Tetrachloride	Linseed Oil
Acetone	Perchlorethylene	Soyabean Oil
Methyl Ethyl Ketone	Glacial Acetic Acid	Corn Oil

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Please send, without cost or obligation, technical data and sample of Monsanto Ortho-Nitrodiphenyl.

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*Company*_____

*Street*_____

*City*_____ *Zone*____ *State*_____

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The Rings have twenty cutting edges or teeth and are designed to maintain their outward position by centrifugal force at specific speeds. In contact with solid metal the rings are momentarily deflected from their usual course because they are free to swing back out of position. No shear pins or other safety devices that require attention.

• Many of the largest and best known process industry plants are making each production hour count to its fullest with AMERICAN Rolling Ring Crushers for grinding, pulverizing, and reducing chemical raw materials of all kinds. They get more tonnage per hour, more uniform product, minimum of fines, no slivers or chips, and all this with lower power consumption, lower installation costs, and lower maintenance requirements. Let AMERICAN engineers recommend the equipment and method best suited to your needs—we maintain a testing plant for prospective users—avail yourself of this service.

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bond makes it of particular interest for bonding fabrics, vulcanized rubber, leather, thin-gage metals, and other pliable materials. Flexibility is also an important consideration from the standpoint of differences in coefficient of expansion, in that temperature changes are far less likely to cause warpage or actual rupture of a bond between dissimilar materials. It is claimed that with Pliobond the bond is permanently flexible and does not become brittle with age or when exposed to low temperatures.

Ease of application is seen as one of the material's most valuable assets, broadening its field to include household as well as industrial use. In the home it may be used as a cold-setting cement which can accomplish just about any domestic adhesion job which might arise, so long as either one of the materials to be bonded is porous. When both materials are nonporous, an ordinary flatiron or the kitchen oven can be used to produce the heat necessary for a strong bond.

In industrial applications, Pliobond has good working qualities and can be applied by brushing, spraying, or any conventional method. If thinning becomes necessary, acetone, methyl ethyl ketone, or any lacquer solvent can be used. Industrial users may also employ Pliobond as a cold-setting cement, though it is probable that they will prefer to use heat and pressure in order to get maximum strength in a minimum length of time. The adhesive is not unduly temperamental and permits considerable variation in the heating and pressing schedule. The solvent employed evaporates rapidly, and under normal conditions the cement will reach the tacky stage for assembly in not more than five minutes and will be tack-free in 10-15 min. Tackiness can be restored by remoistening with solvent or, if it is desired to vary the drying time, other solvents may be substituted.

FABRIC FOR LOOSE LEAF BINDERS

A SYNTHETIC resin-coated fabric, developed especially for producing loose leaf binders, has been added to the Terson line of the Athol Manufacturing Co., Athol, Mass. This fabric is said to combine the appearance and handle of leather with other qualities which make it superior in many ways to leather for this service. As against leather's tendency to dry out, scuff and crack, this new cloth allegedly retains its appearance and serviceability over a long period.

While this cloth is not yet in commercial production in quantity for the civilian market, samples have been made up into loose-leaf binders for the purpose of testing. According to the manufacturer, the experimental binders using Terson possess certain advantages as follows: longer wear, greater anchorage of film to the fabric, high resistance to abrasion, and less surface cracking of the film at the hinge. Tests also showed that the cloth remained stable under drastic climatic changes, and had high resistance to oxidation, water and sunlight and can be made fire-repellent. The Terson coating can be applied to all types of cotton-base fabrics and to many of the new synthetic textiles including nylon and glass.

CHEMICAL ENGINEERING NEWS

NEW PLANT FOR FEED AND FERTILIZER PHOSPHATE

A NEW type of concentrated phosphate fertilizer will be made by TVA near the phosphate beds of middle Tennessee in a fuel-fired furnace plant which begins operations shortly at Godwin, Tenn. The rock is smelted, with silica addition when necessary, to eliminate fluorine in a shaft type furnace in the presence of water vapor.

The new plant is designed to produce 120 tons per day of fertilizer-grade material containing about 29 percent of P_2O_5. If operated more slowly or at higher temperature more complete elimination of fluorine gives a feed-grade material at about 70 tons per day.

The fertilizer-grade material has produced excellent results on certain soils but has not proven as useful as ordinary superphosphate on certain western soils. Commercial rating of the material under state laws may not show fully the contained 29 percent phosphorus pentoxide, the significant component, since it behaves differently both in the laboratory and as plant food in the soil.

The feed-grade product has been successfully used for stock as a substitute for other phosphorus components in the ration. For this purpose the special requirement is that the fluorine content be kept down within proper dietetic limits. So prepared the material is an alternate for bone meal or for the low-fluorine type of dicalcium phosphate which has been used extensively during the last few years. Apparently this new tricalcium phosphate has equal feed value per unit of assimilable phosphorus contained.

ABBOTT RESEARCH GROUP HONORED BY SIGMA XI

FIRST research group in the pharmaceutical industry to qualify for and be granted affiliation with The Society of the Sigma Xi, national honorary scientific society, is the Abbott Laboratories Science Club. More than 180 members of the scientifically trained personnel of Abbott Laboratories attended the installation which was held in the Georgian Hotel, Evanston, Ill., on May 21. Dr. George A. Baitsell executive secretary of the Society conducted the installation and the charter for Abbott Laboratories was accepted by E. H. Ravenscroft vice president and chairman of the board of directors.

NEW PRODUCTS EXPOSITION WILL BE HELD IN CHICAGO

OFFICIAL approval having been obtained, arrangements are in progress for holding the first annual "Products of Tomorrow Exposition" in Chicago. The Office of Defense Transportation is expected shortly to assign a date for the opening that will be sometime between January 1 and March 1, 1946. Chicago has been selected because of its central location and because most of the buildings to house the exposition are already up and ready to be occupied. The Chicago Coliseum, The North Hall Exhibition Bldg., The Armory, The Administration Bldg., all are part of the group to be used. Gardner Displays Co., Pittsburgh, has completed a design for the group of buildings centering on Chicago Coliseum.

The exposition will comprise two main divisions, consumer and industrial products, with the addition of others as the demand requires. Exhibitors will have few restrictions on the design of their displays and the exhibits are expected to provide a springboard for the introduction of new products and new designs by all industry.

Marcus Hinson is serving as general manager of the exposition and he has announced that it will be kept open as long as the weekly attendance warrants.

LAS VEGAS CHLORINE PLANT OPERATED BY STAUFFER

ON May 21, operation of the chlorine, caustic soda, and boiler plants formerly operated at Las Vegas, Nev., by Basic Magnesium, Inc., were turned over to the jurisdiction of Stauffer Chemical Co. and Paul S. Brallier, works manager for Stauffer at Niagara Falls, appointed C. P. Donohoe as plant manager for the Las Vegas units.

On May 17, Basic Magnesium, Inc., a management company in which Anaconda Copper Mining Co. had a controlling interest, was released by the government from all connection with the management and operation of the magnesium plant at Las Vegas which was owned by Defense Plant Corp. Production of magnesium at the plant was stopped last November.

PROCESS FOR RECLAIMING SCRAP ALUMINUM

A PROCESS which chemically separates aluminum from its alloys and other metals, making possible the reclamation of old metal of top quality and producing aluminum virtually the same as that manufactured from bauxite, has been announced by the Aluminum Co. of America at Portland, Ore. Developed by the Aluminum Ore Co., subsidiary of Alcoa, in cooperation with the Air Technical Service Command and the Army Air Forces Salvage Office, the process may be used to salvage aluminum from surplus military planes.

To separate the aluminum, scrapped material is placed in a caustic soda solution which does not attack alloys and other metals. After the solid impurities are removed from the solution, the remaining liquor is processed to pure aluminum oxide by the Bayer process. The reclaimed product, not contaminated by other metals, can be used for the same purposes as other commercially pure aluminum.

OIL CHEMISTS ELECT NEW LIST OF OFFICERS

AN ELECTION by mail ballot, the first in the history of the Society, was held by the American Oil Chemists' Society this spring, and members of the governing board met in Memphis, Tenn., on May 10-12 to transact necessary business. New officers, as announced by the retiring president, K. S. Markley, of the Southern Regional Research laboratory, New Orleans, are as follows: president, Robert R. King, technical director of the Interstate Cotton Oil Refining Co., Sherman, Tex.; first vice president, S. O. Sorensen, technical director of the Archer-Daniels-Midland Co., Minneapolis; second vice president, Reid T. Milner, head of the analytical and physical chemical division of the Northern Regional Research Laboratory, Peoria, Ill.; third vice president, Judson H. Sanders, head of the edible process development group of the chemical division of Procter and Gamble Co., Cincinnati; fourth vice president, C. P. Long, head of the analytical methods section of the standards department, chemical division, Procter and Gamble, Cincinnati; secretary, H. L. Roschen, research chemist, Swift and Co., Chicago, and editor of *Oil & Soap*; and treasurer, John P. Harris, manager, Chicago office, Industrial Chemical Sales Division, West Virginia Pulp and Paper Co.

RECOVERY PLANT PRODUCES AMMONIUM SULPHATE

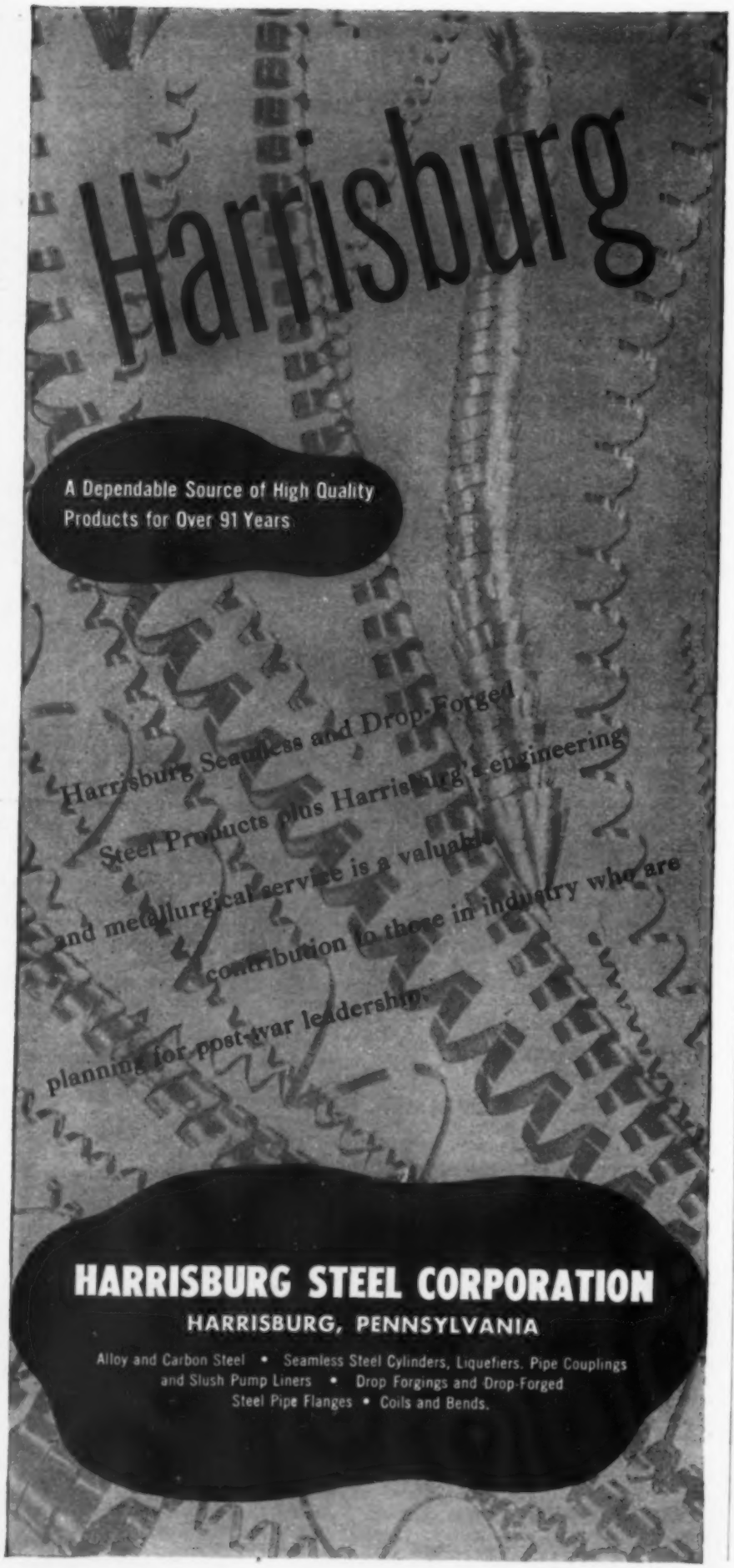
CONSTRUCTION of a non-profit ammonium sulphate plant to transform industrial acid waste into much needed fertilizer and designed to help reduce pollution of the Delaware River has recently been announced by the Rohm and Haas Co. of Philadelphia.

The waste materials come from the manufacture of Plexiglas, the transparent plastic widely used for gun turrets and canopies on fighter planes. Realizing that the acid residue from this manufacture might become a factor in river pollution, a research program was instituted on the utilization of the residue, resulting in a recovery plant now in operation.

ASBESTOS TEXTILE GROUP FORMS INSTITUTE

RECENT discussions by a number of asbestos textile manufacturers have led to the formation of the Asbestos Textile Institute, with offices at 12 So. 12th St., Philadelphia. It is a voluntary, non-profit, unincorporated organization whose function is to render service to manufacturers and to users of asbestos textiles. Membership is open to all individuals, corporations or others located in the United States who manufacture textiles from raw asbestos fibers.

Among the various activities contemplated are the establishment of uniformly high standards of quality, research to de-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velop new uses and new markets for asbestos textiles, and the preparation and distribution of technical and general information that will be of interest and value to engineers, designers, distributors, manufacturers and the general public.

Officers elected are: C. H. Carlough of Carolina Asbestos Co., president; George Marshall, Jr. of Raybestos-Manhattan, Inc., vice president; William C. Scott of Keasbey-Mattison Co., treasurer; and Harris D. McKinney, manager and secretary.

DUPONT REORGANIZES FABRICS AND FINISHES DEPARTMENT

PARTIAL reorganization of the fabrics and finishes department of E. I. du Pont de Nemours & Co. has been announced by J. Warren Kinsman, general manager. E. S. Nickerson is appointed assistant manager of the department; Dr. H. H. Hopkins, director of the Philadelphia Laboratory, is appointed manager of the finishes division; and Matt Denning, director of sales of the finishes division, is appointed assistant manager of that division.

H. R. Lounsbury, refinish sales manager, succeeds Matt Denning as director of sales and in turn is succeeded by D. E. Goldich, mid-west manager of refinish sales. J. W. Nestor assistant manager of industrial sales, becomes assistant director of sales, a new position.

The five research laboratories of the department are being constituted into a chemical division and John Marshall, director of the chemical section, finishes division, becomes director of the new chemical division and Dr. J. Dorman McBurney is assistant director. Reestablishment of the Flint, Mich., finishes laboratory and appointment of Dr. Roy B. Davis as its director also is announced.

MOTOR FUEL PROBABILITIES FROM DOUGLAS FIR TAR

THREE research men at the Oregon Forest Products Laboratory at Oregon State College are studying reports of English chemists on production of high grade motor fuel through cracking of Douglas fir tar. The men, Paul G. Schrader, Bert E. Christensen and Leo Friedman, say that the yield reported by the chemists, if applied to waste from Douglas fir sawmills in the Northwest, would mean production of 25,000,000 gal. of the fuel annually.

FERTILIZER ASSOCIATION CHANGES BYLAWS

THE National Fertilizer Association held a skeleton meeting to make fundamental changes in its bylaws and arrange for new officers and management for the coming year on May 15. The new organization provides a chairman and a vice chairman of the board of directors elected by that body from its own membership. As the principal elected officers of the industry for the coming year, there will serve as chairman M. H. Lockwood, Eastern States Farmers' Exchange, West Springfield, Mass., and as vice chairman F. J. Woods, Gulf Fertilizer Co., Tampa, Fla.

The new bylaws contemplate the en-

KNOW HOW STRONG PORCELAIN IS?

If you're one of those who associate "chemical porcelain" with fragile laboratory ware, you'd be amazed to see some of the Lapp installations and the abuse they take, year-in-and-year-out. Characteristic specifications don't tell the whole story, but service records do. We haven't seen an installation layout where we couldn't conscientiously recommend Lapp Porcelain.

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Safest, surest for flow of Corrosive Chemicals

• The shortest line between one stage of processing and the next is the line that permits regular, non-failing flow of material. In many processes, Lapp Porcelain pipe offers fastest, safest, surest flow. For this material defies attack by any acid (except HF), is dense, smooth and easily cleaned. It prohibits contamination because it will not corrode, because it will not absorb any trace of the liquids going through. Even gasket trouble is ended because the pipe's smooth ground ends permit use only of thin, hard gaskets, or for special requirements, use of no gaskets at all. If you've used Lapp Valves, we'll say that Lapp pipe brings all the same advantages; if you aren't acquainted with Lapp Valves, you should hear *that* story. *Lapp Insulator Co., Inc., Chemical Porcelain Division, LeRoy, N. Y.*

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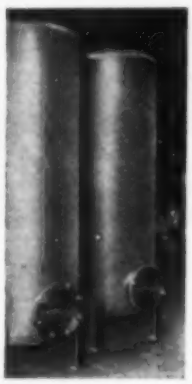
MAIL coupon for this SIMPLE FORM that makes it easy for you to get quotation.



The above is only a partial list of uses for which Adsco builds Heat Exchange equipment. If the exact purpose for which you require such equipment is not listed, chances are Adsco can build it. In some cases, your specific requirements can be met with Standard Adsco Equipment, in which case there would be certain advantages in cost and delivery. Often, however, it is necessary to design and build equipment to fill your space requirements and operating needs.

In either case you will benefit from Adsco's long experience in designing and building Heat Exchangers for a wide range of uses—experience that has given Adsco the engineering skill to analyse your problems—and recommend, or design and build the equipment to meet your exact requirements. Mail the coupon for the simple form illustrated above.

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gagement of a salaried president, but that post has not yet been filled. Daniel S. Murph, who has been the acting executive of the Association since the retirement of Charles J. Brand, has been named definitely as executive secretary and treasurer. He will be in charge of headquarters offices until the new president has been selected.

An important new feature of Association activity is the plan to engage a public relations counsel. A small committee from the board of directors has been named to plan and execute arrangements expected to counteract direct government competition with the industry.

SHAWINIGAN CHEMICALS TO MANUFACTURE CHLORAL

Shawinigan Chemicals, Ltd., is to build a new plant at Shawinigan Falls, Canada, for the production of chloral from acetaldehyde and chlorine. Chloral is one of the principal ingredients used in the manufacture of DDT (dichlorodiphenyl-trichloroethane) the newly developed insecticide. The new plant will be located within the limits of the company's present property and the initial installation will have sufficient capacity to take care of the immediate domestic market. Provision is being made for extension of the plant to take care of any possible future requirements.

The other main ingredient of DDT, monochlorobenzene, is also being manufactured at Shawinigan Falls by Canadian Industries, Ltd., and the Naugatuck Chemicals Division of Dominion Rubber Co., Ltd., is at present producing DDT in commercial quantities at Elmira, Ontario.

MAINE MEETING TO CONSIDER FERTILIZER USE OF LIGNIN

Use of lignin for fertilizers will be discussed at a special closed meeting of the Northeastern Wood Utilization Council to be held in Orono, Maine on June 29. Participants will include leaders of industry, forestry, agriculture and research.

The use of lignin for fertilizers may rank among the most important outlets, on account of the large tonnages involved. It is of special importance to sandy soils as a supplier of humus and organic matter. For example states such as Maine, New Jersey and California, as well as potato growing areas throughout the nation would be directly benefited by its use. The Northeastern Wood Utilization Council is a private non-profit organization doing research on new uses for wood and wood waste in the Northwest and helping to translate this research into local wood using industries.

NEW FERTILIZER FACILITIES FOR WESTERN MARKETS

New facilities for producing ammoniated phosphate and granulated phosphate have recently been put into operation by the Simplot Fertilizer Co., whose $1,000,000 plant at Pocatello, Idaho, with a capacity of some 125,000 tons a year, has been turning out superphosphate since operations got under way last fall. Plant installations for mixing ammoniated phosphate for use on depleted northwest soils

ALUMINAS FOR CATALYTIC PURPOSES

ACTIVATED ALUMINAS (F SERIES)
These aluminas produced from crystalline aluminum tri-hydrate are catalytically active. Hard granules are available in graded mesh sizes up to one inch. Various grades are distinguished by surface area, porosity and soda contents as low as .1%.

ACTIVATED ALUMINAS (H SERIES)
These aluminas are largely amorphous. They have high surface area and sorptive capacity, high resistance to heat and live steam. Experimental lots are now available in minus-20 mesh particles or as spherical balls ¼" to ½" in diameter.

TABULAR ALUMINAS (T SERIES)
These aluminas are a form of corundum, having high strength and resistance to abrasion. They are unaffected by high temperatures. They are available in graded mesh granules up to 1" and as spherical balls ⅝" to 1" in diameter. Balled forms have porosity of either less than 10% or approximately 30%. Granular forms may have porosities of approximately 40%.

OTHER ALUMINAS
Hydrated Aluminas, C-700 Series, have particles less than .5 micron. They become active after being heated to approximately 300° C. Monohydrated Aluminas, D Series, have particles approximately one micron in diameter. They are substantially inactive catalytically but have considerable porosity.

Isomerization reactions are more certain to end with the product you want if your catalyst has Alorco Alumina as its base. High in purity—0.1% or less soda if needed—and free of other undesirable elements, there's less tendency for reactions to branch off in wrong directions.

Listed here are the various types of Alorco Aluminas suitable and used for catalytic work. You may have samples for trial in your own processes. Write ALUMINUM ORE COMPANY, Subsidiary of ALUMINUM COMPANY OF AMERICA, 1910 Gulf Building, Pittsburgh 19, Pennsylvania.

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A MIGHTY FORCE IN WAR PRODUCTION

● Dust Control *is* "a mighty force in war production,"—a silent partner to the mammoth machines, roaring furnaces, striving men and women. Behind the scenes in thousands of war plants and arsenals, that intrepid guardian —Dust Control—is doing a man-size job in keeping the ravages of industrial dust, soot and grime from vital machines, materials and workers.

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● Pangborn Dust Control, the result of forty years experience and research in answering industry's needs, will assure complete and exacting coverage for *your* dust problem. Use Pangborn facilities today and be sure of the best in Dust Control.

"Pangborn Dust Control is Protection for Production"

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WORLD'S LARGEST MANUFACTURER OF DUST COLLECTING AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION • HAGERSTOWN, MD.

were completed late in March and at the same time, drying kilns to produce granulated phosphate by reducing the moisture content of superphosphate were installed. The granulated phosphate is easier to apply by machines and is not so apt to blow off fields as dust fertilizer.

The Simplot plant uses raw pulverized phosphate rock shipped from mines at Conda, Idaho, and sulphuric acid obtained from sources throughout the west. Eventually most of the acid will come from the new plant of the Garfield Chemical & Mfg. Co. at Garfield, Utah. As fertilizer production increases, Simplot plans to increase shipments to include most of the western agricultural states.

INSTITUTE OF CHEMISTS ELECTS COUNCILORS

THE American Institute of Chemists, by mail ballot, has elected the following new Councilors for three-year terms expiring in May 1948: Dr. Norman A. Shepard, chemical director, American Cyanamid Co., New York; Dr. W. D. Turner, assistant professor of chemical engineering, Columbia University, New York; and Dr. James R. Withrow, professor and chairman, chemical engineering department, Ohio State University, Columbus, Ohio. The retiring Councilors are Dr. Donald H. Andrews, professor of chemistry, Johns Hopkins University, Baltimore, and Dr. Foster D. Snell, president of Foster D. Snell, Inc., Brooklyn, N. Y.

HEWITT RUBBER ACQUIRES INTEREST IN MEXICO

THE Hewitt Rubber Corp., of Buffalo and Fabrica de Artefactos de Hule Eureka, S. A., the largest manufacturer of mechanical rubber products in Mexico, have entered into a working agreement. Terms of the agreement as stated by President Thomas Robins, Jr., of Hewitt and Manuel Escandon, general manager of Eureka, specify that Hewitt will supply mechanical equipment and technical know-how to increase the output of the Mexican company. In return, Hewitt acquires a preferred stock interest in Eureka and will receive annual service fees.

An important phase of the agreement provides that key men and departmental heads of Hewitt will, from time to time, visit Mexico to train Eureka technicians in modern methods of manufacture. Eureka also will send men to Buffalo to study domestic manufacturing operations.

NEIL O. BRODERSON HEADS PLASTICS SOCIETY

ELECTION of Neil O. Broderson, president of Rochester Button Co., Rochester, N. Y., as president of the Society of the Plastics Industry, Inc., was announced at a meeting of the board of directors held in New York on May 24. He succeeds George K. Scribner, president of Boonton Molding Co., Boonton, N. J., who becomes chairman of the board following a two-year term in the office of president.

Other officers elected were George H. Clark, Formica Insulation Co., Cincinnati, vice president; and Warren E. Hill, Pro-

Six Eyes for the man who tips the ladle!

At the American Brake Shoe Company plants, one man — with the help of Photoswitch Electric Eye Controls — now pours six ladles of molten iron in less time than was needed to pour one by the old method. Splashing and run-over waste are eliminated, and the operator is far removed from intense heat and danger of burns.

Wherever man's sense of sight, timing or touch must be augmented or replaced for increased production, higher efficiency or greater safety, there is need for electronic control. To meet that need, we have pre-engineered and packaged versatile electronic units for ready application to a multitude of tasks — with a minimum of installation detail. If, for example, you must count automatically, control the movement of conveyors, check liquid turbidity or smoke density, protect property or machinery, check the concentration of liquids in mixture, time machinery operations or manufacturing processes, operate signals, pumps or valves to regulate liquid levels in process control, boiler feedwater or condensate return systems... you can do it electronically with standard Photoswitch equipment. Write today for full information.

Six Photoswitch Electric Eyes watch from above as the empty molds move into position before the pouring ladles. An operator at the control panel tips the six ladles simultaneously and the molten iron flows into the molds. As the white-hot metal reaches the riser of each mold, a brilliant light is thrown off — a signal to the watching "eye" that the mold is full. Instantly, Photoswitch drops the ladle back and the pouring automatically stops at the precise level desired.

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HOW STRONG SHOULD A CHIME BE
This shows how the five thicknesses of steel form a chime.
These V-shaped rolling hoops do not flatten out or dent easily.
Section through lug type closure that is liquid-proof, airtight and siftproof.
Protection bead on pails adds materially to its strength and utility.
Offset bottom, an important design feature of all Inland Steel Container pails permits containers to be stacked and rolled together.

Strength in the chime is a major factor in establishing the strength of the container. Inland Steel barrels, drums and pails have a chime formed by five thicknesses of steel joined together by the double-seaming method, producing an unusually strong joining of the head and body of the container — strong enough to stay leakproof under the rough handling encountered in shipping. At regular intervals in the manufacture of Inland Steel barrels, drums and pails, sections of these extra strength chimes are cut and tested to make certain they are being perfectly formed.

Emphasis on strength in the design and structural features of Inland Steel Containers have won the unqualified preference of America's manufacturers and shippers.

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phy-lac-tic Brush Co., Florence, Mass., secretary-treasurer. William T. Cruse is executive vice president with headquarters in New York.

MORE LABORATORIES JOIN AMERICAN COUNCIL

ELECTION of four new members to the American Council of Commercial Laboratories is announced by A. J. Nydick, executive secretary of the Council. The new members are: The Smith-Emery Co., Los Angeles, Calif.; Southern Testing Laboratories, Birmingham, Ala.; Twin City Testing & Engineering Lab, St. Paul, Minn.; and The Twining Laboratories, Fresno, Calif.

YOU CAN HELP

PAPER is a Number 1 war material shortage—because over 700,000 different war items are wrapped, packaged, labelled, tagged, or made from paper or container board. The Pacific war, when it speeds up, will require stupendous amounts of paper and board since double and triple packing are required for protection against weather, insects, etc. So please:

1. Share this magazine with your associates. Because of the paper shortage, the number of copies is limited.
2. Organize for a continuous drive in your office and plant to collect waste paper of any kind to put into paper salvage. Clean out old files, dead correspondence, obsolete records, useless display materials, cartons, etc.

DO THIS EXTRA BIT TO HELP

CHARLESTON SECTION OF AIChE ELECTS OFFICERS

AT THE May meeting of the Charleston Section of the American Institute of Chemical Engineers the following officers were elected for the 1945-46 year: J. R. MacMillan, chairman; R. F. Moran, vice chairman; G. H. Fremon, secretary; A. W. Barry, treasurer; and J. F. Roe, member-at-large.

ROSIN SOAP RUBBER ROLLING OFF KENTUCKY LINE

MORE than 10,000 tons of GR-S-10 synthetic rubber have been turned out in the government plant operated at Louisville by The B. F. Goodrich Co. since manufacture of this special variant of GR-S rubber began last June. One of the plant's four production lines is devoted to this type of rubber—sometimes called "rosin soap rubber"—which is now being produced at the rate of 15,000 tons a year. Recently a similar production line for this rubber was established in the plant the company built and operates for the government at Port Neches, Tex.

Having properties which reduce tread cracking and increase road wear, this special rubber "marks another forward step in the nation's synthetic rubber technology," said W. S. Richardson, president of B. F. Goodrich Chemical Co. It is a butadiene-styrene copolymer of the same

now—an instrument for measuring and recording vibration

in a 4" x 5" x 7" package

Westinghouse announces the Vibrograph—a handy, portable instrument that instantly produces a permanent graphic record of the frequencies and amplitudes of all mechanical vibrations. Its operation is entirely mechanical . . . with no external connections to make, no data to record, no films to develop.

The new Westinghouse Vibrograph measures vibrations in the frequency range of 600 to 15,000 cycles per minute, with amplitudes as small as .0001" or as great as 1/16". These vibrations are permanently recorded by the instrument on a transparent celluloid strip. The strips can then be immediately examined under a low-power microscope—which is included with each Vibrograph.

A new illustrated bulletin, B-3046, gives complete information about the new Westinghouse Vibrograph. Write for your copy today. Westinghouse Electric & Manufacturing Company, Box 868, Pittsburgh 30, Pa.

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- Wide Operating Range
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- May be Used in Any Position
- Compact Construction
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Westinghouse

Vibration Analysis

Instruments

One of a series of mammoth STRAIGHTFLO MORRIS PUMPS which are to be installed in the Butadiene Plant of the Rubber Reserve Company, at Port Neches, Texas, a U. S. Government sponsored project.

3,000,000
GAL. PER HR.

The immense water supply required for the Port Neches Butadiene Plant will be pumped from a nearby river by Straightflo Morris Pumps. In an expeditious manufacturing program, the Morris Machine Works designed, tested and delivered the first two pumps within three months. Each pump, directly driven by a 350 hp. electric motor, delivers 3,000,000 gallons of water per hour; 72,000,000 gallons a day constant service. Each pump unit weighs 15 tons, the over-all height is 30 feet, and discharges through a 48-inch diameter outlet.

Morris Straightflo Pumps are also used extensively for irrigation and drainage projects. Consultation on pumping service, is available to you, from the Morris engineering department.

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MORRIS CENTRIFUGAL PUMPS

general type as the GR-S which constitutes about four-fifths of the national production schedule. But whereas GR-S uses for emulsion a soap solution having a fatty acid base, the GR-S-10 type uses soap with a base of rosin acid, derived from the abundant southern pine.

REFRIGERATION EQUIPMENT MAKERS ELECT OFFICERS

F. J. Hoon, vice president of the Ansul Chemical Co., Marinette, Wis., was elected president of the Refrigeration Equipment Manufacturing Association at a meeting of the new board of directors in the LaSalle Hotel, Chicago on May 24. He succeeds Arthur B. Schellenberg, president of the Alco Valve Co., St. Louis.

Other new officers chosen at the meeting were H. F. Spoehrer, Sporlan Valve Co., St. Louis, vice president; Edward M. Flannery, Bush Mfg. Co., Hartford, Conn., secretary; and J. A. Strachan, Weatherhead Co., Cleveland, treasurer. R. Kennedy Hanson continues as executive secretary with offices in the association's general headquarters in Pittsburgh.

OREGON PLANS LARGE USE OF DDT AS LARVICIDE

First large-scale use of DDT for other than direct war purposes is scheduled for this summer in the coastal area of northwestern Oregon where Crown-Willamette Co. will spray 10,000 acres of timberland in an effort to rid the trees of hemlock loopers, moths in the larva stage.

The powerful new insecticide, widely used by the armed forces for control of disease-bearing insects, will be mixed with carrier oil and sprayed on the timber stands from airplanes. Officials of Crown-Willamette hope to save about 50 percent of the trees on which the larvae feed.

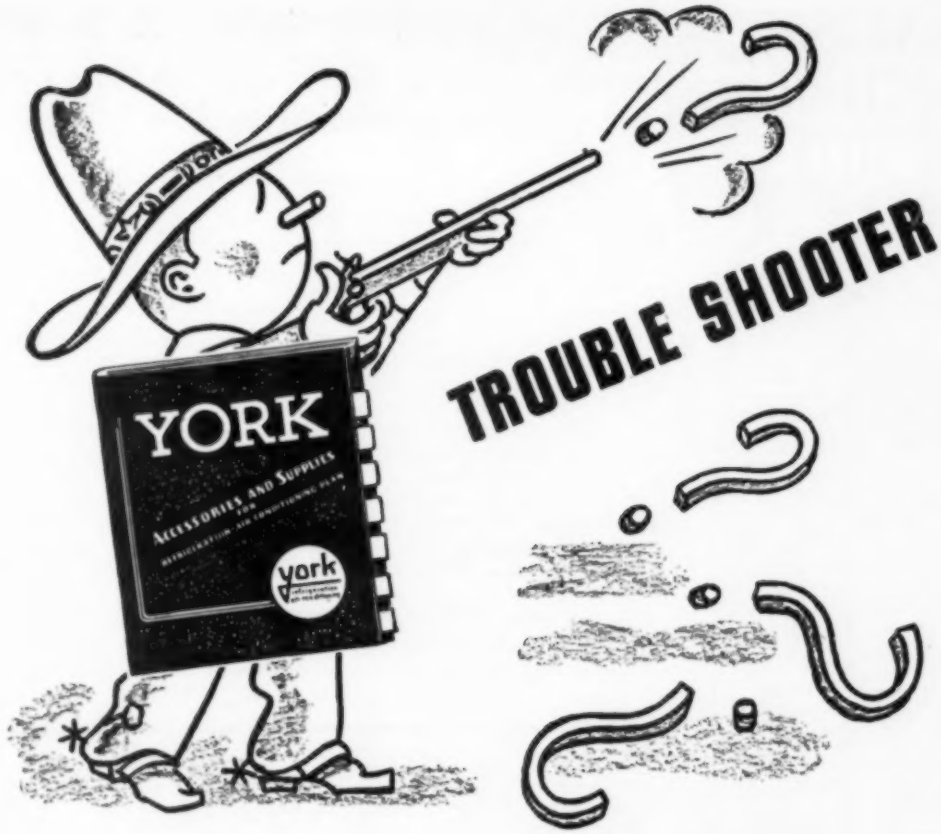
BATELLE SETS UP RESEARCH FOR EYE PROTECTION

To aid in furthering the eye protection of industrial workmen, a new research program has been initiated at Battelle Institute, Columbus, Ohio, under the sponsorship of the American Society of Safety Engineers, engineering section of the National Safety Council.

To involve a year of investigation, the program is intended to provide information that will be used by safety experts and eye-protector manufacturers to help in combating the some 75,000 disabling eye injuries and several hundred thousand non-disabling injuries that occur annually in American industry. The investigation will apply particularly to the evaluation of the performance requirements and specifications of satisfactory plastic eye protectors, which are now finding increasing use in industry.

DUPONT PLANS EXPANSION OF CELLOPHANE PLANT

Application to the War Production Board has been made by E. I. du Pont de Nemours & Co. for a major expansion at its cellophane plant in Clinton, Iowa. The expansion program, if approved by WPB will require about a year to complete.



...answers your questions about Valves and Fittings and other Accessories and Supplies

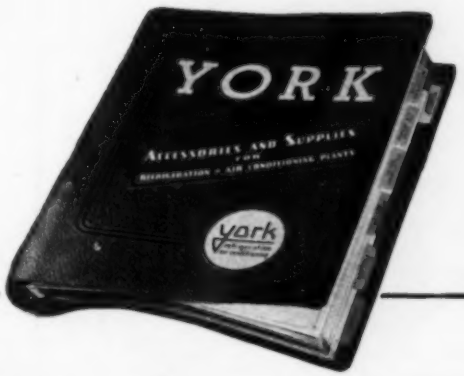
Having trouble with valves and fittings, renewal parts or oil? Just consult the "York Catalog of Accessories and Supplies for Refrigeration and Air Conditioning Plants" and you'll mow them down. Here's the breakdown of its conveniently tabulated information-packed sections:

ICE CANS AND AIR FITTINGS • RENEWAL PARTS
ACCESSORIES AND SUPPLIES • COLD STORAGE DOORS
VALVES AND FITTINGS • TABLES AND DATA

Sizes, weights and performance data are dealt with in detail. Photos, mechanical drawings, descriptions . . . *even net prices* are included. Its loose-leaf form enables us to keep your catalog constantly new and up to date.

We'll be glad to send you this unique reference free. Just drop us a note on your letterhead—today!

York Corporation, York, Penna.



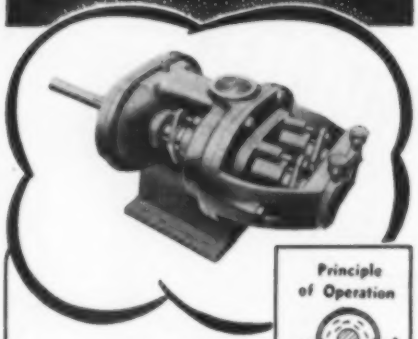
The "York Catalog" is a mine of useful knowledge. Here are just a few more of the subjects you will find in its easy-to-locate sections:

Air Filters	Cork Pipe Covering
Automatic Controls	Freon
Calcium Chloride	Motors and Pumps
Charging Connections	Oil
Coils and Piping	Purge Drums
Cork Board	Thermometers and Gauges

YORK REFRIGERATION AND AIR CONDITIONING

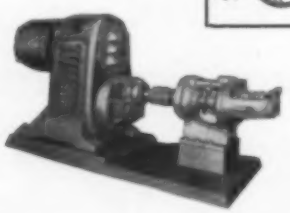
HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

for continuous
PRODUCTION
BUMP PUMPS

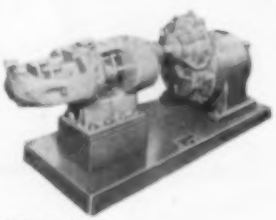


Principle of Operation

There's a Bump Pump to meet your requirements, whether you pump thin or viscous liquids—a pump that delivers a constant volume per revolution regardless of the speed or pressure. Bump Industrial Pumps are positive types, self-priming under vacuums or against head pressures, and are capable of being operated at slow speeds. No agitation, churning, nor vibration take place within the pump. Available from ½ to 400 GPM capacities.



Variable speed industrial model



Direct drive industrial model

Tight and loose pulley industrial model

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NEWS FROM ABROAD

BRITISH CHEMICAL MANUFACTURERS STUDY PROBLEMS OF RECONVERTING WAR PLANTS

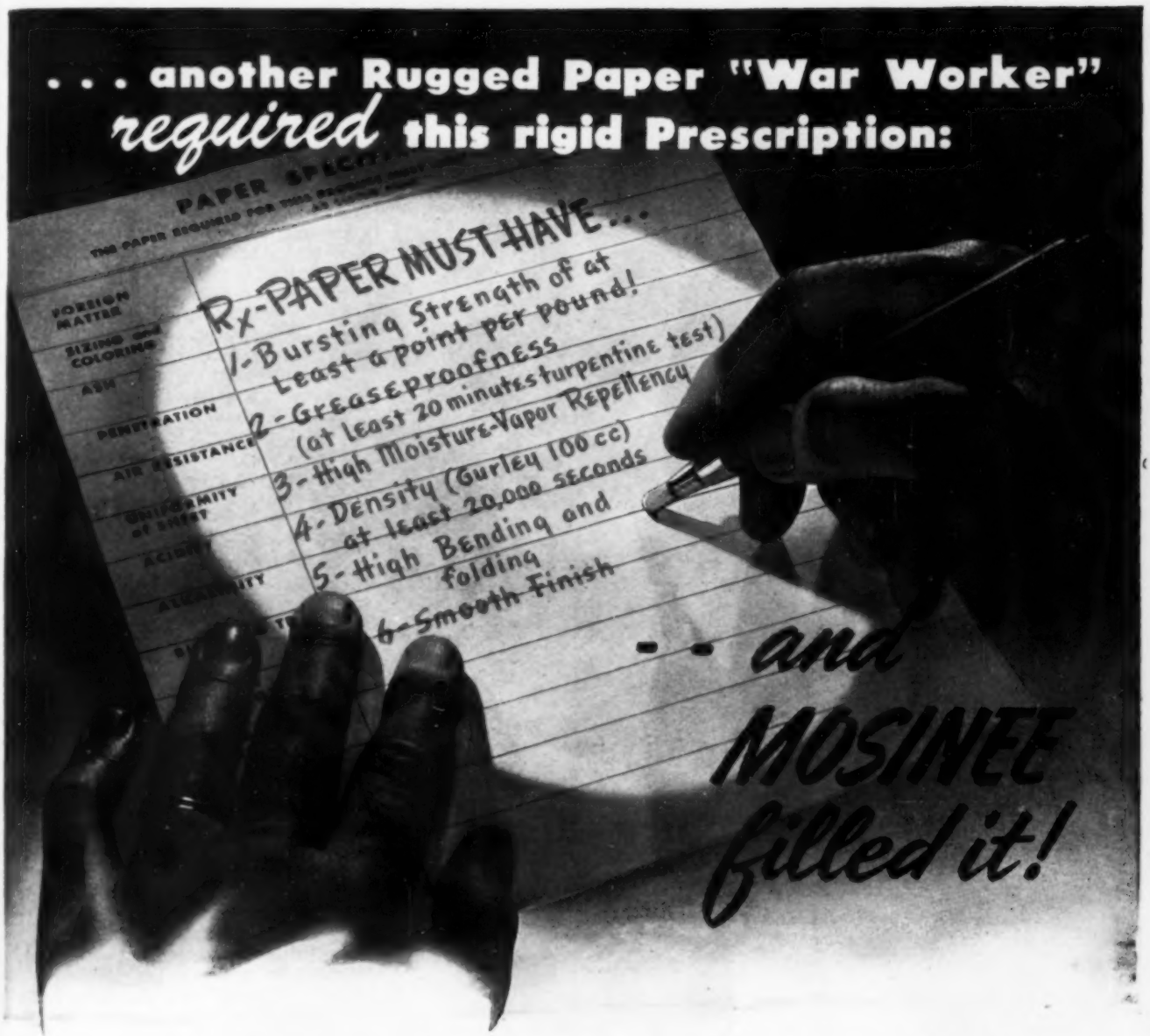
Special Correspondence

BRITISH chemical manufacturers, released from the need to focus their attention on war production requirements, are chiefly interested in two major questions: recovery of their export trade and factory switch-over to peacetime needs. Both these tasks demand considerable preparation and planning, for not only have commercial contacts with foreign customers been interrupted but recent experience in armament production has revealed grave shortcomings and backward methods in plant layout and construction. Now the time has come for an entirely new start, embodying the best foreign practices and taking full advantages of the vast opportunities created by six years' arrears in civilian plant construction and civilian goods supply.

Initiative and enterprise are not lacking in the British chemical industry, but there is no underrating either of the serious handicaps under which factories will in future operate. The cost of plant, labor, fuel and most raw materials is greatly in excess of prewar figures. Control has come to stay for some time after war. Urgent reconstruction work will make heavy demands on manpower and essential commodities, to say nothing of the continuing military needs for the Far Eastern war. Nor has advance planning been helped by

Innocents Abroad—Here's how a few of the "synthetic" American "soldiers" in Europe on technical investigations appeared to the editor of The Industrial Chemist and his equally famous cartoonist on the occasion of the April 5 "soiree" at the Chemical Club in London

. . . another Rugged Paper "War Worker" *required* this rigid Prescription:



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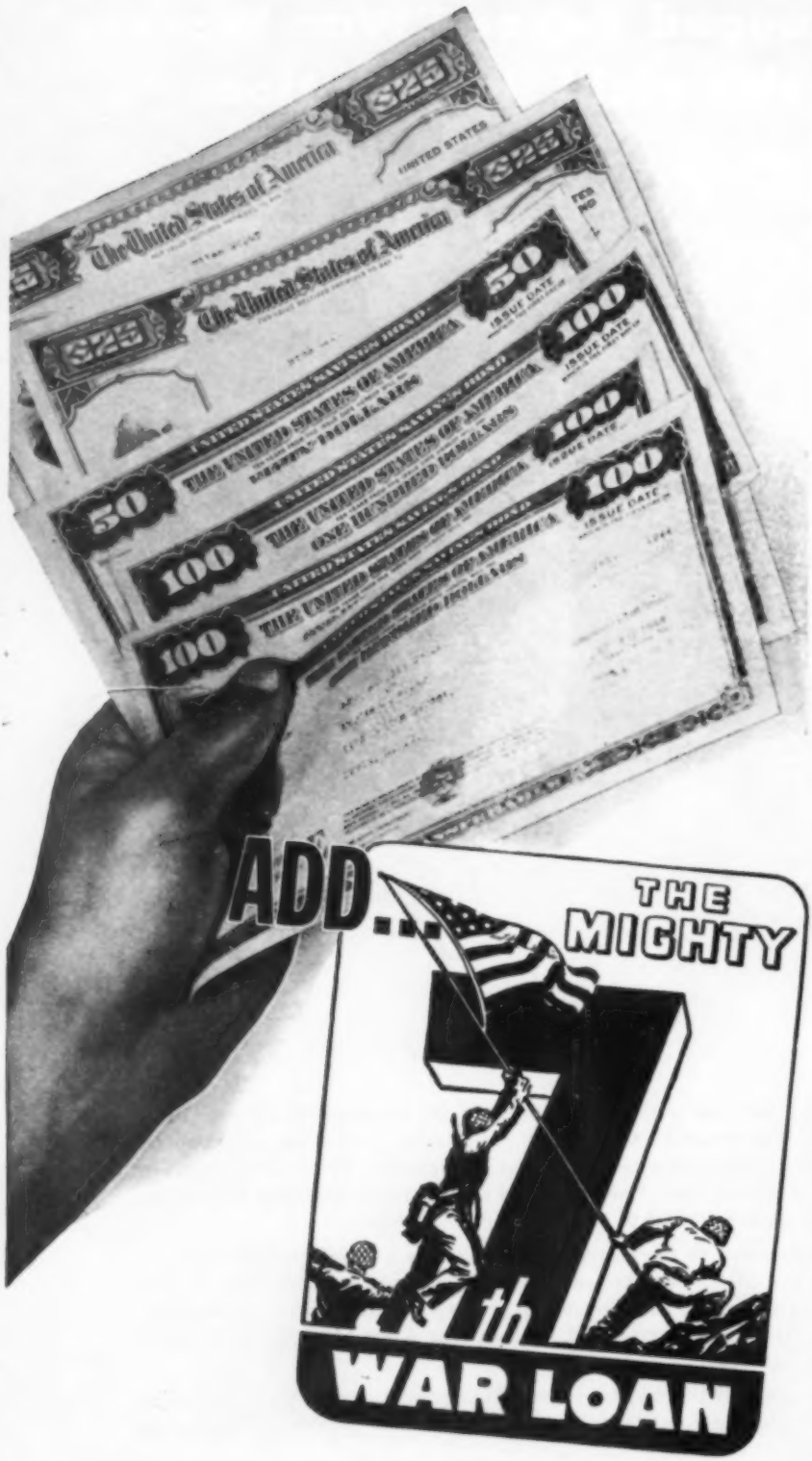

A War Bond Message Designed and Contributed by Buell Engineering Company, Inc., New York

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DUST RECOVERY SYSTEMS

official reluctance to formulate a clear economic policy.

And yet, if much of the postwar jig-saw puzzle remains to be filled in, the first pieces show much evidence of optimism, enterprise and sound judgment. Naturally the biggest firms occupy a leading position in planning for the future. Courtaulds, the preeminent rayon producer, announced at the shareholders' meeting that orders have been given for a 50 percent increase in the size of the firm's staple fiber factory in North Wales, that a new site has been acquired near Belfast (which will be one of the largest industrial developments in Northern Ireland for many years and give employment to several thousand workers), and that negotiations were going on for the purchase of factory sites in West Cumberland and near Dundee. British Nylon Spinners Ltd., a joint Courtaulds-I.C.I. subsidiary, is purchasing a site for a full-scale nylon spinning factory in South Wales.

Courtaulds also is giving attention to the extended manufacture of chemicals for the company's own use and contemplating important extensions to the plant of its Canadian subsidiary. Further, the combine has bought a site for a large rayon and staple fiber plant in Australia and has certain other parts of the British Empire under consideration. Needless to say, these projects will take years to complete, and construction work may be delayed by the government's refusal to release from the services even key men for planning and design.

REGIONALIZATION

Courtaulds' postwar plans are especially interesting, not only because of the extent of the big program itself, but also because they indicate certain tendencies characteristic of British industry at the present time. The trend towards regionalization, reflected by the decision to erect several big plants in or near major consuming markets, is typical. So is the desire to attain self-sufficiency in the chemicals needed for the company's main production. So is the intention to extend Courtaulds's research organization and to establish plants in promising overseas markets. As far as the entry into chemical industries of outside interests is concerned, another interesting illustration was provided by the registration of Shell Chemical Ltd., a new £100,000 subsidiary of the Royal Dutch-Shell oil combine, after earlier moves in this direction of coal and plastics companies, and it seems that some of the ferrous and non-ferrous metal producers will follow the Shell's example.

The trend towards regionalization of British industry is likely to be furthered by the government's policy in favor of certain heretofore neglected industrial districts and the leasing of surplus armament plants, also largely concentrated in certain regions, to private firms. When the president of the Board of Trade recently stayed at Newcastle, he gave a list of new industrial ventures to be started in the Tyneside district. Factories for medical and food products, for plastics, for tonic beverages, for asbestos spinning, for penicillin, and for titanium paints are among those to be built in North-East England, and most of these will be based on a local market, to

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be supplied by products made from imported raw materials by local labor with local fuels.

Similar developments can be noted in North-West England where the closing of armament factories in Lancashire and West Cumberland will be followed by the establishment of industries entirely new to these regions. A beginning in this direction was made by the lease of an aircraft factory on Merseyside to the Dunlop Rubber Co. Not all these factories are intended to work for a local market, and some of them are expected to help the regions in question to participate in the export trade.

CHEMICAL EXPORTS

As far as British chemical exports in general are concerned, the figures for 1944 revealed a further increase in value as compared with 1943, but these statistics are surrounded with so many "ifs" and "buts" that they are of little value as an indicator of likely postwar trends. In volume the 1944 total was only 80 percent of the 1938 figure. This is not really bad, considering the particular wartime difficulties of shipping and raw material supply. Of the total of £28,100,000 of "manufacturer chemicals, drugs, dyes and colours" the United States took £4,000,000, India £5,500,000, Australia and New Zealand £2,900,000, Eire £1,300,000, South Africa £1,300,000, West Africa £900,000, East Africa £350,000, the British West Indies £700,000, Ceylon £350,000, and Palestine £250,000. Egypt with £1,500,000, the Dutch West Indies with £850,000, and Iran with £500,000 are other important destinations connected with war purposes, while such typical peacetime markets as Brazil, Argentina and Chile together absorbed only £1,800,000 against £4,200,000 in 1943 and £3,000,000 in 1942. The 1944 figures are thus clearly overshadowed by wartime conditions.

In future, British chemical manufacturers may find it easier to receive releases for exports, and some of the foreign trade restrictions have already been eased, thus indicating the government's desire to put no avoidable difficulties in the would-be exporters' path. This, however, it is generally thought, is not enough, and many of the leading firms think that entirely new ways must be followed. It is not coincidence that British chemical manufacturers have been especially interested in various organizational developments for official support of exporters by credits or credit guarantees.

The latest move for cooperative export assistance is the formation of the British Export Trade Research Organization which was founded by Lever Brothers and Unilever Ltd., Beechams Export Corp., British Insulated Cables, Dunlop Rubber, General Electric, Horlicks and a number of other firms and is open to other British exporters. Its object is to establish a substantial organization to obtain first-hand information on overseas markets, marketing and sales methods, primarily from field staffs and marketing investigators on the spot.

For wartime purposes British chemical manufacturers are cooperating in various export groups which exist for china clay,

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A-39

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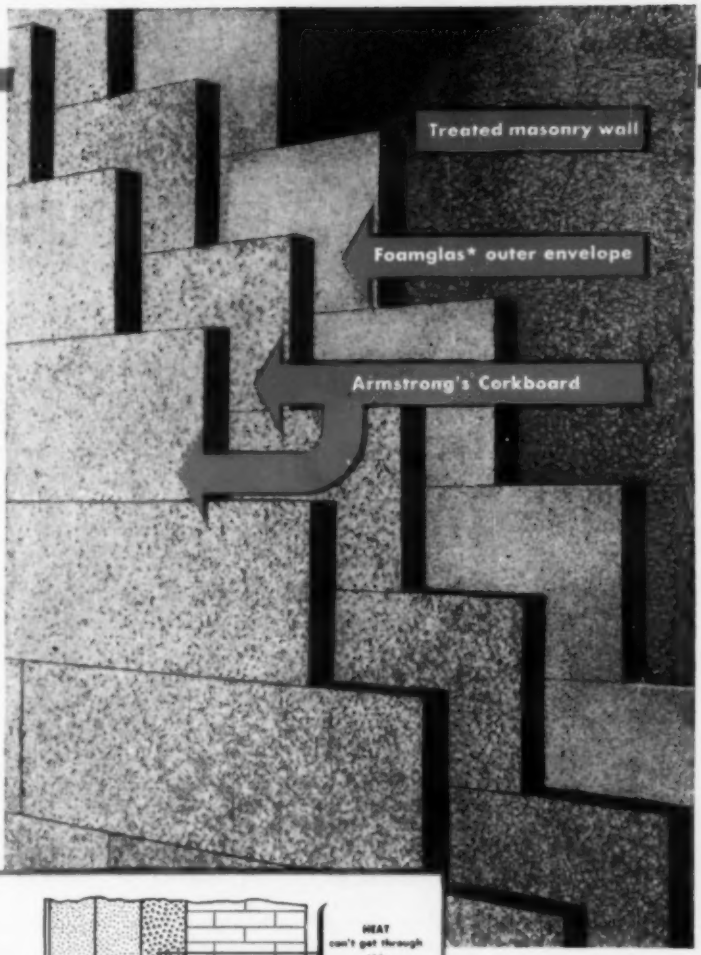

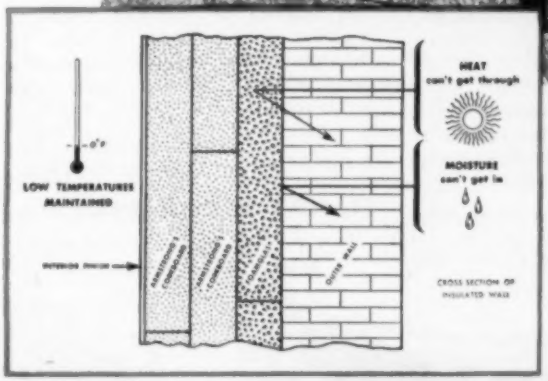

A Combination construction (above) for a 20° F. below zero cold room at the Merchants' Terminal Corp., Baltimore, erected by Armstrong's Contract Service. Standard interior finishes are used.

◀ Diagram (at left) shows how Armstrong's new construction bars heat and moisture.

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dyestuffs, fine chemicals, heavy chemicals, lead oxide, white lead, magnesia, paints, pigments, soap, glue and gelatine, and plastics, and it is possible that at least some of these will carry on after the war. These export groups have been recognized by the Export Council of the Board of Trade. In the past they were largely concerned with dividing export orders among the various interested firms to ensure that the largest number of overseas customers should be supplied and thus retained as potential buyers for postwar days, and they have also endeavored to obtain more favorable treatment for their members in the way of packaging, paper supplies, etc. It is by no means impossible that such cooperative methods will be retained and indeed extended. It is at any rate unlikely that they will disappear immediately with the end of the European war.

At present the shipping position provides the greatest obstacle in the way of an expansion of chemical exports. Even where control regulations do not prevent sales overseas and all preparations for shipment have been made, the actual dispatch is frequently delayed by lack of shipping tonnage. It is reported that larger quantities of chemicals have been released for export to the Near and Middle East and to India, and as far as finished products, especially pharmaceuticals, are concerned, a revival of trade with continental markets is imminent.

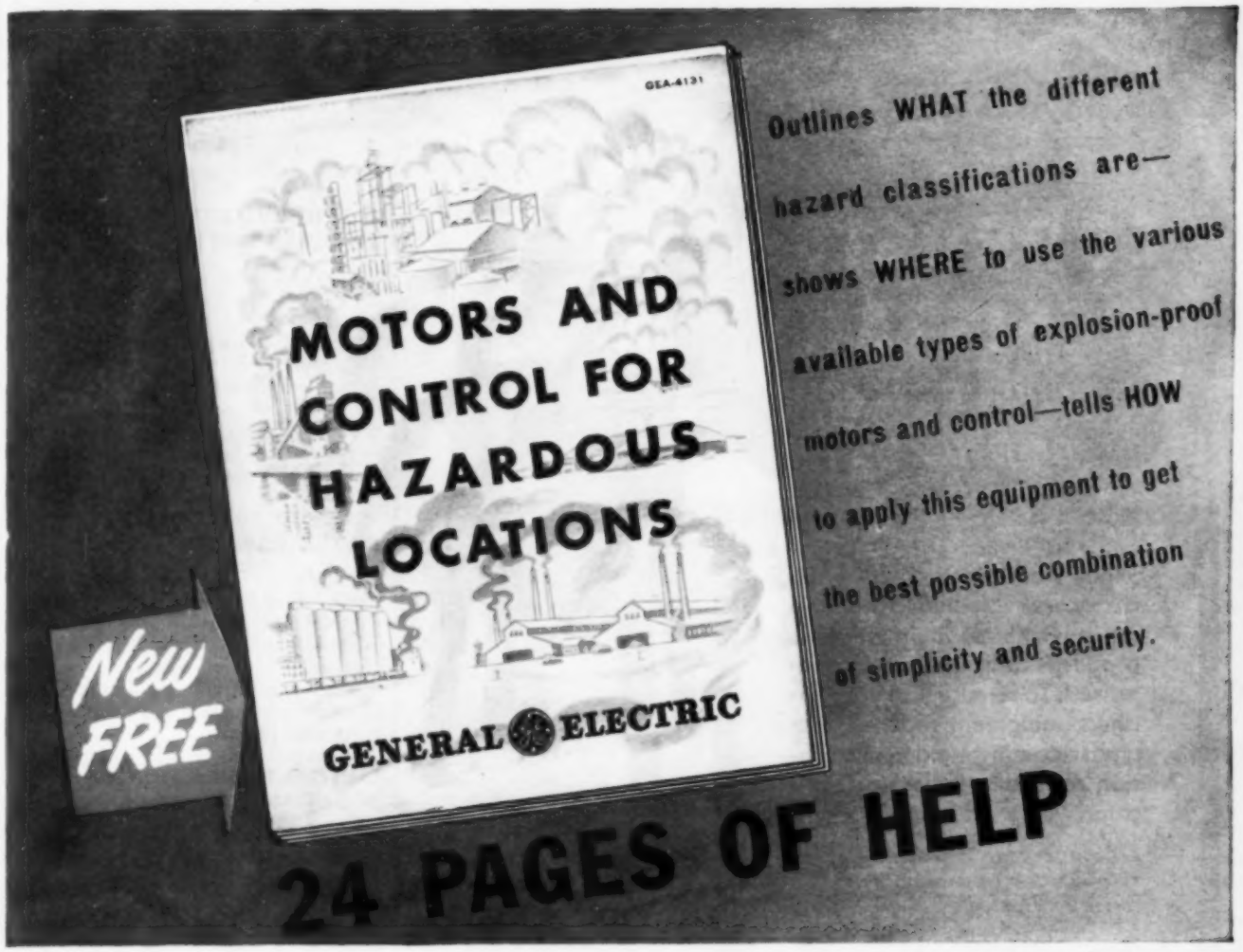
In some overseas countries where trade was restricted by wartime import controls steps have been taken to remove unnecessary obstacles. This is true, for instance, of the important Indian market. The commercial agreement with Sweden provides for British supplies of heavy chemicals. Another difficulty which is bound to become increasingly felt is the general advance of prices due to inflated producing and distributing costs. Coal in particular seems to become more and more expensive, and the consequent rises in the prices of coal-tar products cannot but impede the export business in those commodities which enjoy export outlets chiefly because they are cheaper than competitive foreign products. There have been price reductions in several directions, and further cuts may be expected, but the general level of British export prices is likely to remain considerably above prewar standards.

ARGENTINA IMPORTS LESS ANILINE DYES

PRELIMINARY compilations indicate a sharp drop in maritime imports of aniline dyes into Argentina last year. Imports in 1943 amounted to 1,092 metric tons and the preliminary figure for 1944 is 804 metric tons or a decline of approximately 25 percent. The United States and Switzerland were the principal supplying countries.

CANADA EXTENDS SCOPE OF CHEMICAL OUTPUT

Two chemicals not previously produced in Canada are now being turned out in that country. A small unit is making synthetic quinoline at the rate of 10,000 lb. a year. The product is said to be more than 98 percent pure and especially suited for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Outlines WHAT the different hazard classifications are—
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Electrical Distribution in Hazardous Areas

In addition to a section detailing the design requirements of motors and control for both Class I and Class II conditions, you will find specific, helpful facts on electrical distribution systems, on methods of wiring, and on protective devices.

Maintenance Hints

An important section of this new book is devoted to suggestions for extending the "life expectancy" of explosion-proof motors and control. It emphasizes especially how to preserve the effectiveness of their explosion-proof features. It should prove a boon to anyone setting up a maintenance program.

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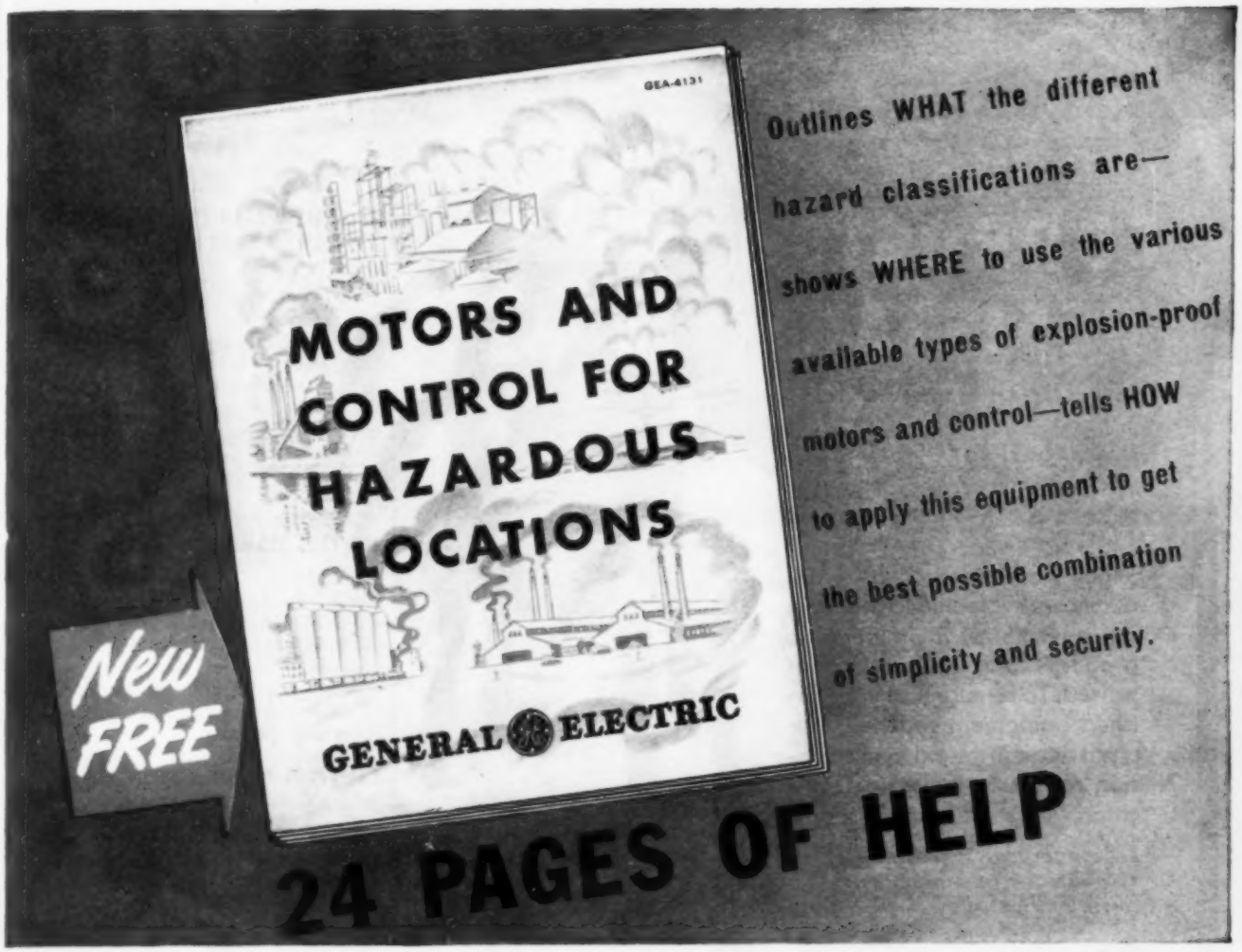
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When stainless steel and other alloys are subjected to fabricating operations, their valuable properties may be altered or impaired. To be sure that your finished equipment reaches your plant retaining maximum corrosion resistance, select a fabricator with these qualifications:

1 *Look for long experience, definite specialization in working with corrosion resistant alloys.*

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2 *Be sure that your fabricator has the* special *equipment and trained manpower to work the alloys properly and to* guard *their properties during fabrication.*

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3 *Make certain that your fabricator employs competent engineers to consult with your staff in evolving the best construction and design for your problem.*

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We have specialized in fabricating equipment of stainless steel and the corrosion resistant alloys in gauges to 3/16" since these alloys became a factor in industry. We are equipped to build the processing vessels you need for your applications. On your next job, consult with us.

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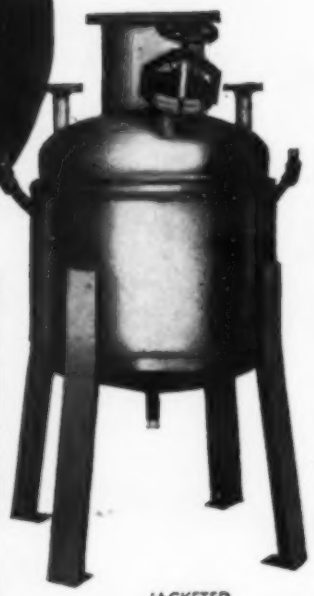

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use as an intermediate in the manufacture of pharmaceuticals.

A pilot plant with a capacity of 120,000 lb. is utilizing a new process for the production of crotonic acid and its commercial applications are being investigated especially its use in the plastics industry.

TEXTILE MACHINERY NEEDED IN INDIAN MILLS

An unofficial report on the textile industry in India states that during the war period no machinery has been available for renewal and replacement and most of the equipment in use is about 40 years old. It has been estimated that in a few years these mills will want to replace the 10,000,000 spindles and 200,000 looms it now possesses. Considerable printing and finishing machinery also will be needed.

SEAWEED PROCESSING PLANTS IN THE HEBRIDES

The plant for processing seaweed at North Boisdale, South Uist, Hebrides, United Kingdom, has had the power plant, processing tanks, and electrical equipment installed. Another survey of potential seaweed supplies near the Hebrides is to be made this summer and additional factories may be built.

LIMITED PRODUCTION OF BORAX IN IRAN

Deposits of borates are known to exist in the vicinity of Debschutran and in the north near Sabsevar, Iran. Those near Debschuturan are considered more important and are estimated to have reserves sufficient to produce about 2,000 metric tons of refined borax. Limited operations are being conducted in this area but the deposits near Sabsevar are not being worked. The crude material now produced is transported to Tehran for refining but this amounts to only about 100 tons a year, the cost being higher than that at which American borax may be purchased.

RUSSIA DEVELOPS NEW RUST PREVENTIVE

An antioxidant and rust preventive known as "Unikol" has been developed in Soviet Russia. It was discovered in the Colloid Chemistry Laboratory in Moscow and its first extensive use was for removing rust from equipment captured from the enemy. It is now used on a large scale for a number of purposes including the preservation of oil-well casings.

BRAZILIAN RAYON PLANTS REPORT LARGER OUTPUTS

According to data collected for rayon production, the five manufacturing companies in Brazil turned out 9,297 metric tons in 1944 as compared with 7,367 metric tons in 1943. Of the 1944 production, 27 tons were cuprammonium and 541 tons staple fiber. Production since 1940 appears to have been sufficient for domestic consumption with a small surplus for export. Imports consist mainly of types and qualities which are not produced in Brazilian plants.

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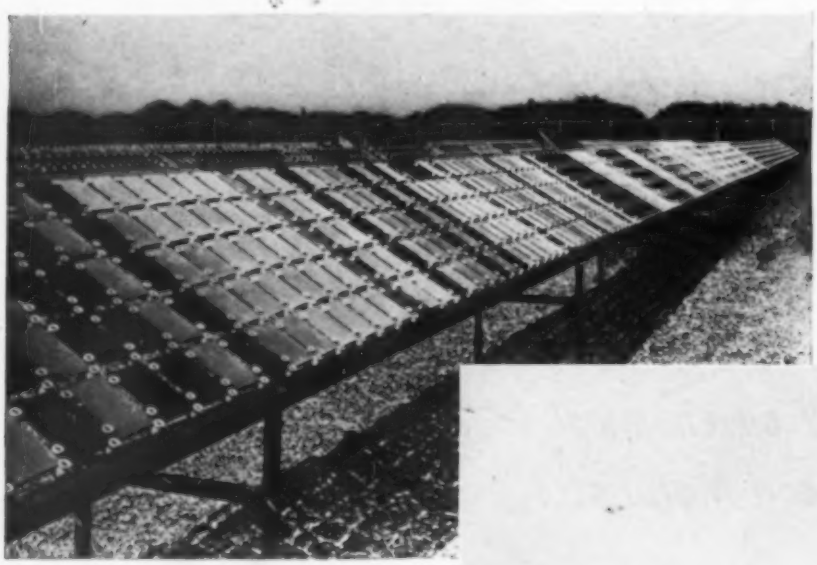
CORROSION FORUM

EDMOND C. FETTER, Assistant Editor

MODERN MATERIALS • MODERN METALS



Left—Atmospheric lot at Kure Beach, N. C., where more than 15,000 specimens are exposed to sea-air corrosion

Below—Kure Beach facilities for conducting seawater tests. Specimens are bolted, via insulators, to metal racks. Swung in place by crane, racks are hung from steel beams, left for year or more in flowing seawater

KURE BEACH TEST STATION

To THOSE who are close followers of corrosion literature, the name Kure Beach has become familiar as the site of one of the most comprehensive studies of corrosion by seawater and sea air ever attempted. Many thousands of specimens have been exposed during the ten years the tests have been in progress, and the literature is studded with the data obtained.

SEAWATER TESTS

The ideal facilities at Kure Beach for conducting seawater tests may be credited to the peculiar topography of the North Carolina coastal region south of Wilmington. Here, the Cape Fear River, at its mouth, flows for six or seven miles almost parallel to the coast line, forming a long, slender peninsula, with the sea and the river separated by less than a mile of low sand dunes. These geographical features first attracted the Ethyl-Dow Co. to the site for the construction, in 1933-34, of a large chemical processing plant, the advantages from that company's point of view being that the sea is completely free from pollution and the Cape Fear River is close at hand to carry treated water back to the ocean at a point far removed from the intake.

In constructing facilities for handling large quantities of seawater (thousands of gal. per min.), the Ethyl-Dow Company created almost perfect conditions for conducting seawater corrosion tests. A long, shallow pond stretches across the peninsula and acts as a reservoir for untreated water. Fresh seawater is continuously pumped up into the pond at the ocean end, and is continuously drawn off through a canal and into the plant at the river end. It is in this canal, where the water has a velocity of 2 ft. per sec., that the corrosion specimens are hung. The period of exposure of a set of specimens may vary from six months to several years—the longest to date being ten years. The number of specimens exposed varies from about 2,000 to 4,000. The station was started by International Nickel Co. about ten years ago. Later, the Carnegie-Illinois Steel Co. and Dow Chemical Co. joined Inco and added facilities for exposing large groups of specimens.

The distinct advantage of the facilities at Kure Beach lies in the rare combination of conditions provided. First, there is a continuous supply of full-strength seawater—but at the same time there is no tide to contend with and no surf or heavy sea to buffet the specimens about. Moreover, the water is not contaminated by industrial waste, pollution or oil films which interfere with tests in harbors and near large cities. There are other advantages: Relatively wide variation in seawater temperature (35 to 85 deg. F.); a long season of growth for a large number of marine organisms—of particular value in studying anti-fouling alloys and coatings; a moderate fluctuation in water level which permits observation of water line and intermittent immersion effects when desired; the presence of the chemical plant, whose guards and fences insure against tampering or theft of specimens, and whose personnel and machinery are available to erect testing equipment, keep it in repair, and handle the heavy racks of specimens.

MARINE ATMOSPHERE EXPOSURE

In addition to the seawater study, a sea-air test station has been established jointly by Dow Chemical, International Nickel, and Carnegie-Illinois Steel. The combined tests of these three companies have resulted in an impressive display of more than 15,000 specimens—involving an estimated cash outlay of better than a quarter

F A M O U S

Caustic Comments

In the course of conversation at a cocktail party, a tactless woman remarked to the late Alexander Woollcott, "I don't like you . . . I simply cannot bear nitwits."

"You are not at all like your mother, are you?" was Woollcott's caustic rejoinder.

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million dollars. This lot is located about 250 yd. from the ocean shore. Racks face south and the specimen frames are set at an agle of 30 deg. from the horizontal. Details of the frames and the manner of supporting specimens on porcelain insulators may be seen in the photograph.

Though most of the panels are alloys of magnesium, nickel, or steel, the tests run the entire gamut of metals and alloys. Studies are also being made of some organic and metallic coatings and of a few plastic materials. Effects of atmospheric corrosion are measured by visual observation, weight loss, and changes in mechanical properties. Certain key materials are exposed to determine year-to-year changes in the corrosivity of the atmosphere itself, and other control panels are scattered at random over the racks to be sure that rack position has no effect on the results.

COOPERATIVE COMPETITORS

As far as the conducting of tests is concerned, the Ethyl-Dow Co. keeps hands off, being content to donate the site and let each experimenter execute his research as he sees fit. In addition to the concerns mentioned previously as having extensive tests in progress, practically all of the nation's producers of ferrous and non-ferrous metals and alloys have contributed specimens at one time or another. At least once a year, representatives of these companies, and of large-scale users of materials in marine service, visit the test station to examine specimens and compare notes.

"Comparing notes" is, in fact, one of the most significant features of the Kure Beach activities—and one of the most promising from the viewpoint of those who will eventually use the materials investigated. In spite of the fact that many of the cooperating organizations are direct competitors, representatives of all companies work together, exchange data rather freely, examine each other's test panels and even weigh specimens and scrape barnacles for each other. This spirit of cooperation is all the more impressive when you reflect that only fifteen or twenty years ago many of these same companies were hardly on speaking terms with each other. Apparently, the various metal producers are coming to the conclusion that it is more profitable to make a frank appraisal of the proper field of application for their various classes of materials, and let that, rather than sheer do-or-die competition, become the basis for their merchandising. It is a certainty that if the producers stand to profit by their change in attitude, their customers will profit even more.

It is not possible to list here the names and activities of all the participating companies, but a few may be mentioned as typifying the work being done. Carnegie-Illinois Steel is primarily interested in low-alloy and stainless steels. In prosecuting its studies of these materials, large numbers of specimens have been exposed both to seawater and the atmosphere. Protective metallic coatings for steels are also being studied in great variety and detail. The Mellon Institute is working with anti-fouling paint in an effort to

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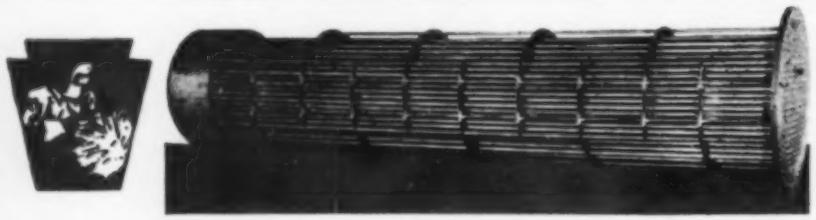
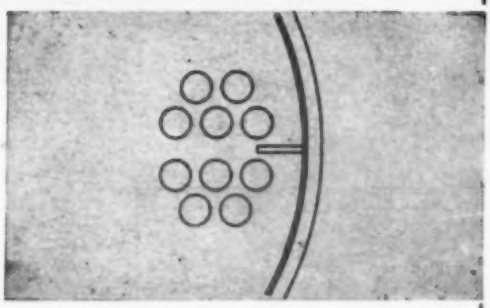


PERFORMANCE and ECONOMY..
two important factors of PRACTICAL DESIGN



Cross Section view of Heat Exchanger showing Sealing Strips for blanking off potential by-passing where tube bundle does not entirely fill the shell.

A Downingtown designed unit must not only work but it must give trouble free, reliable performance over a reasonably long period, and it must be economical both in first cost and in maintenance expense. Here is an example of Downingtown efficient design, the purpose of which is to break up the flow of liquids outside the tube bundles. This result is attained by utilizing two separate sets of sealing strips on each side, in order to eliminate thoroughly any possibility of channeling of the shell side fluid.

Our heat exchanger Knowledge is backed by over thirty years consecutive experience in the field of pressure vessel fabrication. Repeat orders in Heat Exchanger Equipment were over 70 per cent of Downingtown's 1942-43 business.

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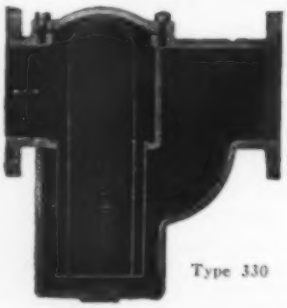

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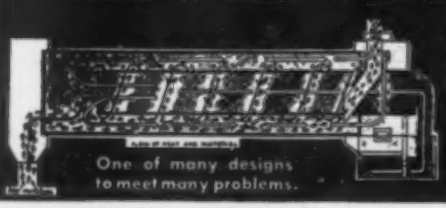

One of many designs to meet many problems.

Dryers
Calciners
Coolers

determine the basic mechanism by which fouling and corrosion are prevented by such coatings.

International Nickel has undertaken a broad, diversified program involving several thousand specimens. One of their recent investigations has been a study of the relationship between corrosion and fouling. Active cooperation in this and other studies of fouling has been given by William S. Clapp of the Clapp Laboratories, well-known in his field as an authority on all kinds of marine organisms. Bridgeport Brass is testing a wide variety of copper-base alloys in seawater, and the Aluminum Co. is proceeding similarly with their aluminum-base alloys. Several special investigations are being carried out on behalf of the Navy.

Dow Chemical's investigation of magnesium alloys includes some seawater tests but is given over primarily to atmospheric exposures. In the "atmospheric lot," besides many standard panels like those illustrated, the company has set up many complete aircraft structures (ailerons, wing sections, bomber wheels, etc.), as well as an array of tension-loaded specimens to observe the effects of combined stress and exposure. A series of arc- and spot-welded panels demonstrates the effects of good and bad methods of fabrication.

The foregoing enumeration of participants is by no means complete, but it gives an indication of the scope of the investigations. To the chemical engineer it may seem that these investigations, since fouling and marine corrosion are not ordinarily among his every-day problems, are rather far afield. But they are none-the-less noteworthy, for the reason that they show the extent to which cooperative research can be carried—even among competitors. And the fact that the program is now in its tenth year is rather conclusive evidence that cooperation is a profitable business. Kure Beach, therefore, contains a suggestion which chemical engineers might well apply to their own thinking and their own problems—corrosion or otherwise.

LITERATURE REVIEW

"Corrosion and Biofouling of Copper-Base Alloys in Sea Water," *Trans.* The Electrochemical Society 87, preprint 26 (1945):—Exposure of 240 test pieces at Kure Beach, N. C., leads to the conclusion that, in the case of copper alloys, slight modifications in these alloys by addition or subtraction of minor constituents can greatly affect their resistance to corrosion, fouling, and impingement erosion.

"Corrosion of Steels in Marine Atmospheres and in Sea Water," C. P. Larrabee, *Trans.* The Electrochemical Society 87, April 1945, pp. 123-140:—Data are presented which show that the corrosion of steels in various atmospheres depends upon the composition of steel or alloy (see accompanying graph) and upon the amount and type of pollution. In seawater, plain and low-alloy steels are shown to have an average corrosion rate of about 0.004 in. per yr. average penetration. Pitting attack characterizes the corrosion of stainless steels, although the

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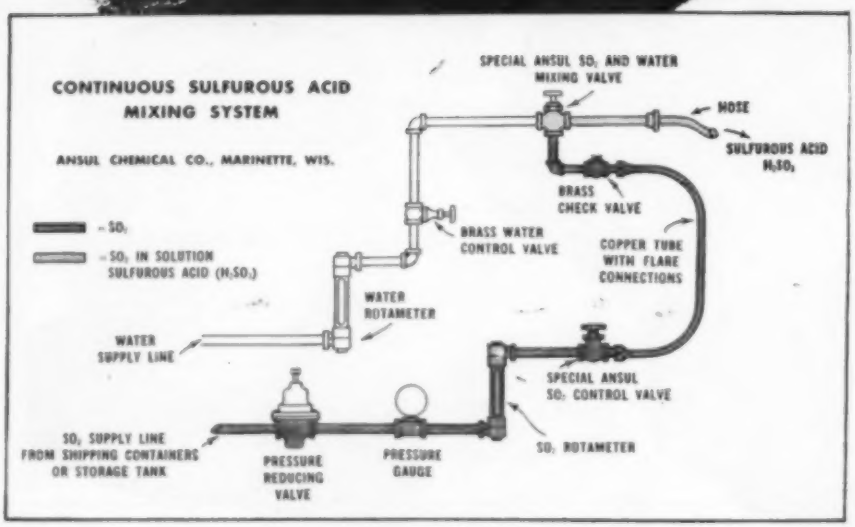
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PHYSICAL PROPERTIES

Chemical formula	SO_2
Molecular weight	64.06
Color (gas and liquid)	Colorless
Odor	Characteristic, pungent
Melting point	−103.9° F. (−75.5° C.)
Boiling point	14.0° F. (−10.0° C.)
Density of liquid at 80° F.	(85.03 lbs. per cu. ft.)
Specific gravity at 80° F.	1.363
Density of gas at 0° C. and 760 mm.	2.9267 grams per liter (0.1827 lb. per cu. ft.)
Critical temperature	314.82° F. (157.12° C.)
Critical pressure	1141.5 lbs. per sq. in. abs.
Solubility	Soluble in water
Purity	99.9+% (by wt.) SO_2 (H_2O less than 0.01%)

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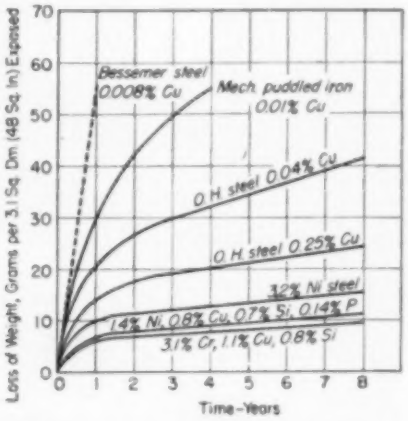
presence of 2-3 percent Mo in the 18-8 type or very high alloy content diminishes this tendency.


Loss of Weight, Grams per 3.1 Sq. Dm (48 Sq. In.) Exposed
Time—Years
Bessemer steel 0.008% Cu
Mech. puddled iron 0.01% Cu
O.H. steel 0.04% Cu
O.H. steel 0.25% Cu
12% Ni steel
1.4% Ni, 0.8% Cu, 0.7% Si, 0.14% P
3.1% Cr, 1.1% Cu, 0.8% Si

Comparative corrosion resistance of different steels in an industrial atmosphere, Kearny, N. J.

"Corrosion by Phenol at High Temperatures," A. Wachter and N. Stillman, *Trans.* The Electrochemical Society, 87, April 1945, pp. 115-122:—Special refining procedures currently employed in the petroleum industry involve use of phenol at high temperatures. Investigation by a simple experimental procedure has shown that: (1) Small additions of water (0.2-0.6 percent) to anhydrous phenol decrease markedly the corrosion rate of low-carbon steel, although further addition of water increases the corrosion rate. (2) Increase of temperature above 200 deg. C. greatly increases the corrosion of low-carbon steel. (3) Phenol containing sulphur compounds is much more corrosive to steel than pure phenol. (4) Comparative resistance of different alloys is as shown below.

Corrosion of Various Alloys by Phenol

Corrosion Rate, In./Yr. × 1,000 (From Weight Loss)

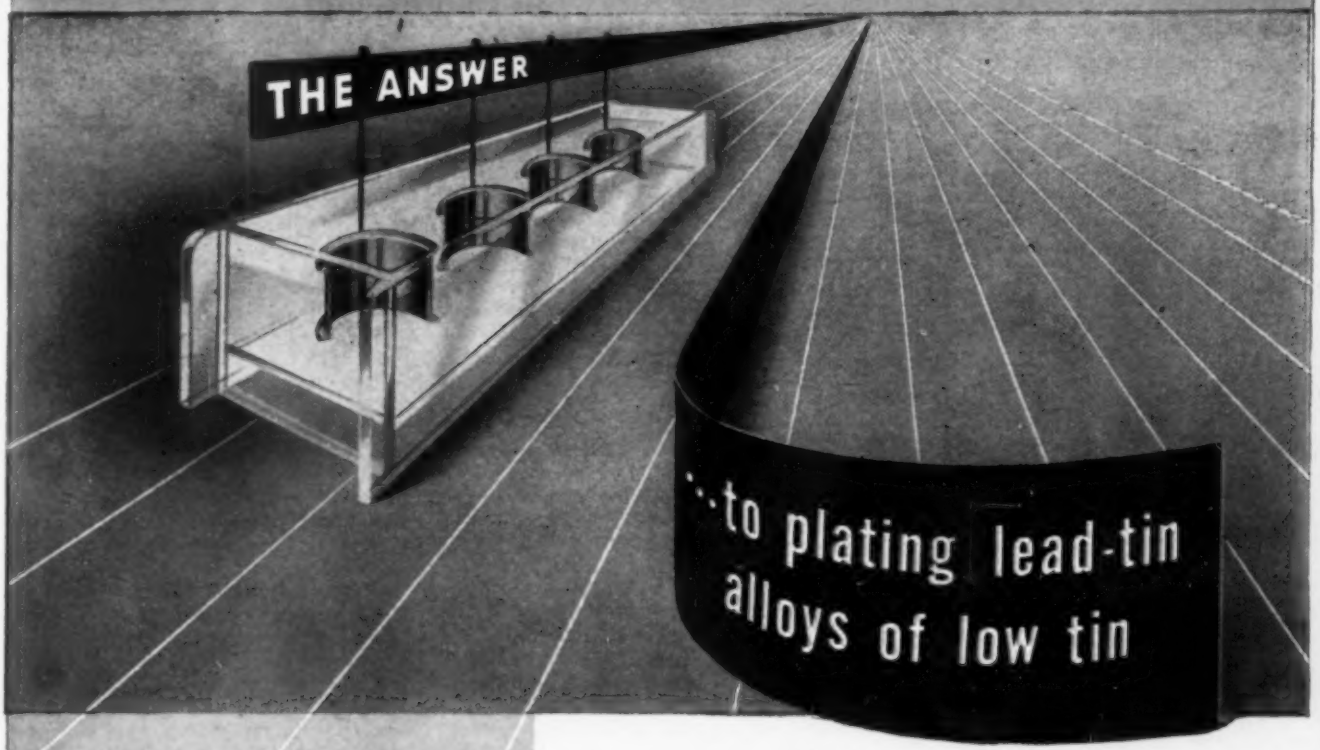
Alloy Tested	Pure Phenol	Used Plant Phenol*	Pure Phenol + 0.5% S as Butyl Disulphide
Low-carbon steel	30	43	75
12-Cr steel	24	10	21
18-8 stainless	0	0	2
18-8 Mo stainless	0	1	1
Durimet stainless	1	0	1
24-20 stainless	1	0	1
Nickel	0	31	4
Aluminum 2-S	2,200	..	..

Conditions: Polished metal strip, 0.25 by 2 in., immersed in 10 g. of phenol sample dehydrated by distillation, in evacuated and sealed glass tube, at 310 deg. C., stagnant for 24 hr.

* Sample contained 0.137% S as sulphur compounds.

"Properties of Stainless Steels Affect Welding Methods," and "Welding Requirements for Various Stainless Steels," W. J. Conley, *American Machinist* March 1, 1945, pp. 91-94, and March 15, 1945, pp. 112-115:—The first article reviews, class by class, the physical and corrosion-resistant properties of the various types of Cr-Ni and straight Cr steels. The second article prescribes the welding procedure to be used for each class of stainless steel; it also presents diagrams, and a table showing the proper wire size, number of passes, amperage, arc speed and electrode consumption for each of 37 typical joints.

"A General Chemical Research Achievement"



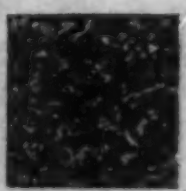


Fig. A: Lead Plating (100% Lead—0% Tin) *150 Diameters*

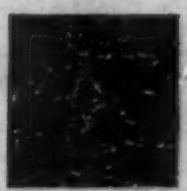


Fig. B: Lead-Tin Alloy Plating (91% Lead—9% Tin) *150 Diameters*

When tin *is* plated out simultaneously with lead from General Chemical Lead and Tin Fluoborate solutions, the lead-tin alloy plate obtained consists of a smooth, even cover in contrast to the grainy surface of the lead plate alone.

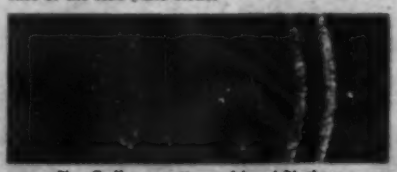


Fig. C: X-ray pattern of Lead Plating

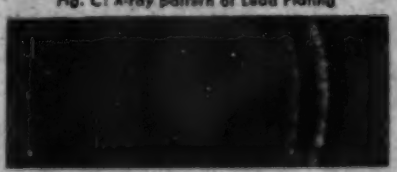


Fig. D: X-ray pattern of Lead-Tin Alloy Plating (91% Lead—9% Tin)

Coarse grain spots in Fig. C coalesce in Fig. D to form more uniform lines, indicating finer grain structure. Only lead lines appear in both patterns since the tin atoms have entered the lead lattice to form an alloy in Fig. D.

For more than 25 years metal finishers have sought a successful means of plating lead-tin alloys in the low tin ranges. "Not feasible . . . inoperable . . . too many variables," read published reports on method after method.

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Thus, *in one operation* an alloy coating is produced that is harder, more wear-resistant, and has a more attractive appearance than lead plate alone. Little wonder that leaders in the bearing industry are adopting the combination fluoborate bath for lead-tin alloy plating of their products.

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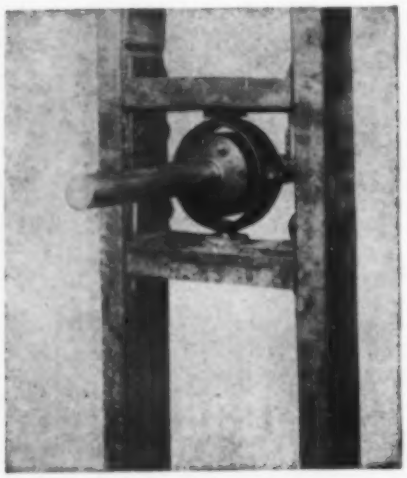
FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer



Trunnion-and-gimbal housing for deep-groove bearing

THE OLD MAN, during a Sunday peregrination through the works about twenty years ago, chanced to observe a new ball bearing pillow block which the mechanics were installing in the raw sugar elevator drive to replace an ancient babbitted contraption. The typical managerial inquisition followed. The price of $47 and $7 respectively demanded justification. Well, we had expended up to that time about $10,000 for antifriction bearings and had achieved an annual saving of $10,800 in oilers' wages and $800 in lubricants, not to mention an unknown reduction in power loss.

Then the Old Man walked through the char house and observed that we were replacing the old oil-bearing rollers under the char-conveyor belts. He demanded the reason "why in ——," the old rollers, which had served faithfully for years and were completely amortized were now thrown out and replaced with new ones costing $15 each. The justification was this: There were eighty rollers in the conveyor each having two bearings. Because of the heat and dust, each bearing required a drop of oil twice every 24 hours. The oilers therefore exerted at least 320 squirts of oil daily or 96,000 per year. Besides, the marksmanship was of low order as could be seen by the oil splotches on the floor. On the other hand, the ball bearings, 160 in number, required greasing twice a year, or 320 unit greasings annually.

Parenthetically, a few of the early flat-belt rollers were purchased from an inexperienced manufacturer who had just discovered that he could attain low cost by welding the shafts through the center of the discs with which the ends of the pipe rolls were closed. However he did not achieve concentricity and so the belt moved with a vertical joggle that gradually worked the material off the edge. The rollers must be concentric with the shaft especially in the case of flat belts on which plows are used for discharging bags. In one of our installations, the corners of the bags sometimes caught under the plow. In this case we elevated the discharge end of the plow slightly above the entering end and thus avoided pinching between the bottom of the plow and the belt. A corner that caught under the plow would thus release as the bags progressed towards the dump. This suggestion was as simple as the "dumb" operator who made it. He knew nothing about mechanics but his suggestion saved us a lot of "sifters" which could be translated into dollars.

BALL BEARINGS in the sugar house started by the replacement of the babbitt lining of the ancient pillow block with ball races. A babbitt bearing, slightly misaligned and having a "sugar house" fit of $\frac{1}{32}$ of an inch, can be kept cool with oil. On the other hand, a deep groove ball bearing in a rigid housing and subjected to the strains of a shaft deflected by heavy belt loads, will wreck itself in a short time. To overcome this, ball bearings intended for line shafts are given greater clearance than those required, for example, for a lathe.

Other devices are ball-and-socket housings or self-aligning bearings in which the outer race is ground spherically while the inner race is grooved for two rows of balls or rollers. The old style shaft is anchored by means of collars at one bearing; the modern shaft is anchored by having one ball bearing stabilized while the rest are permitted some longitudinal movement in the housing to avoid strains due to temperature effect. The inner races are clamped rigidly to the shaft, and for this purpose concentricity is most advantageously secured by means of an adapter sleeve and nut. Rigid clamping is important to prevent slipping and wearing of the shaft.

Rear end of scroll conveyor with gimbal-mounted bearing

TAKE-UPS for elevators and belt conveyors offer some slight awkwardness to ball bearing applications, unless ball-and-socket housings are used. Self-aligning bearings, allowing a misalignment of a few degrees, make a satisfactory job but the good old faithful mechanic, who can abide no interruption in production, has got to use a more sensitive procedure in adjusting the take-up.

On the other hand, the standard sugar-house practice of mounting the bearings in the hubs of the foot pulleys avoids complications. The shaft is then stationary and the ends are supported in eyes attached to the take-up screws. Self-aligning bearings with expansion sleeves and nuts provide comfortable mounting and do not require refinement in machining.

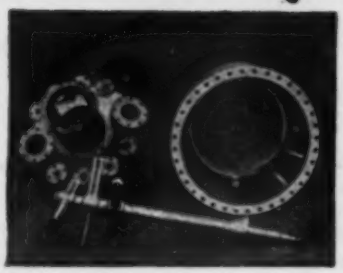
DEEP-GROOVE ball bearings, disadvantageously, demand accuracy of alignment. A deflection in the shaft induces strains that shorten the life of the bearings. On the other hand they have the advantage of excellence in carrying both radial and thrust loads. The harsh strains can be avoided by supporting the bearing in a ball-and-socket pillow block or in a trunnion-and-gimbal mechanism after the manner of the universal joint that carries a ship's compass.

Scroll conveyors, made in long sections to reduce the number of bearings inside of the troughs, are bound to deflect. For these, an effective drive end is provided by a deep-groove bearing housed in a trunnion-and-gimbal support as shown. The overhanging shaft end is fitted with a sprocket and chain drive which makes a perfectly flexible coupling to any source of power.

This style of bearing is the refinery standard for scroll conveyors, for vertical mixer shafts hung from the ceiling and projecting into tanks, for the ends of the elements in the rotation leaf Vallez filter, for rotating coil heaters ("hot minglers") or any other application that requires an effective step bearing, especially when the shaft does not run true. The flexibility of the housing avoids needless strains to such an extent that there have been no failures of any of these bearings since they were first installed 15 years ago.

Thirty-six of these, $4\frac{1}{4}$-in. bore or more, are installed in minglers and Vallez filters and a large number of smaller ones in

Lead-lined Equipment demands Precision Fabrication



In the fabrication of lead-lined equipment, a high degree of skill, and more than the average care are required.

Acme craftsmen with their specialized knowledge have eliminated the "bugs" from this and other difficult production problems.

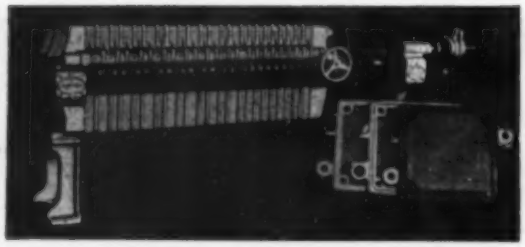
In the use of many materials—lead steel, copper, brass, stainless steel, aluminum—Acme experience and facilities assure the precision fabrication that results in efficient production.

ACME

Processing Equipment

ACME COPPERSMITHING & MACHINE CO., ORELAND, PA., U. S. A.

Shriver leak-proof corner feed, closed delivery, aluminum filter press with feed channels for steam circulation through the hollow filter plates; vinyon filter cloth used.



SHRIVER FILTER PRESSES

MORE VERSATILE • MORE EFFICIENT

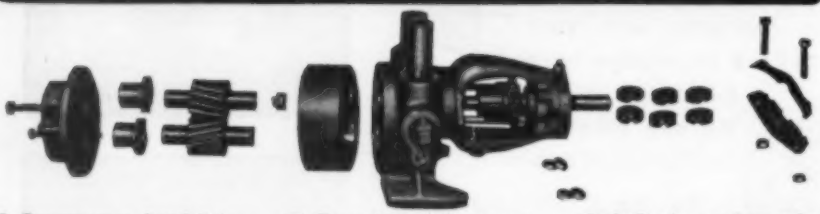
The design, range of capacities and materials of construction of Shriver Filter Presses make them the most widely used filtration equipment. They are low in first cost, easy and efficient to operate, whether for cake recovery, cake washing and drying, clarification, decolorizing or other correlated purposes.

Shriver not only recommends and builds the filter best suited to your needs but also carries a large stock of cotton, wool, vinyon and glass filter cloth and filter paper for immediate shipment.

Write for Catalog

T. SHRIVER & COMPANY, Inc.
802 Hamilton St. · Harrison, N. J.

HOW ROPER PUMPS CAN BE SERVICED WITHOUT DISTURBING PIPE CONNECTIONS OR MOUNTING



1 Two cap screws, threaded into jack screw holes, pull face plate. Front flanged bearings and gears slip out easily. Flexible slider coupling is removed thru hole in opposite bearing.

2 The gasket-sealed gear case separates from back plate. Back flanged bearings are easy to get out. The back plate, pipe connections, mounting, and power unit, remain intact.

3 Stuffing box can be repacked quickly with split-ring packing by removing 2-piece cap. Split-gland slides forward on shaft to allow clearance, serves as lamp, and is also removable.

Send for Catalog and Booklet "How To Solve Pumping Problems" No. 6-41

ROPER DESIGN CUTS DOWN-TIME

As illustrated above, Roper Pumps are designed for easy accessibility to working parts. It's not necessary to disturb piping, power unit, or pump mounting to inspect or replace gears, case, bearings or packing.

When an old unit needs attention, or a destructive foreign element causes trouble, easy accessibility to internal parts cuts down-time . . . helps speed up the service job. Interchangeable parts and packings are available promptly.

GEO. D. ROPER CORP., ROCKFORD, ILL.

PUMPS ESPECIALLY ENGINEERED TO FIT YOUR REQUIREMENTS

BUILDERS OF PUMPS FOR MANUFACTURING, MARINE, PETROLEUM AND PROCESS INDUSTRIES

conveyors and vertical shafts. The numbers in use have been further multiplied through absorption by visiting brethren. The tail bearing in a scroll conveyor provides freedom for shaft expansion by having the trunnion shaft mounted in a square block that slides in a slot in the supporting beam.

CHUCK ECKMAN became nauseated by CO_2 while working in a fermenter one day last summer. At noon he went home and to bed. He awoke with a start when the clock struck seven, got his breakfast and beat it to the plant. There he punched the time clock and suddenly as he looked westward, it dawned upon him that the sun was on the wrong side of the meridian!

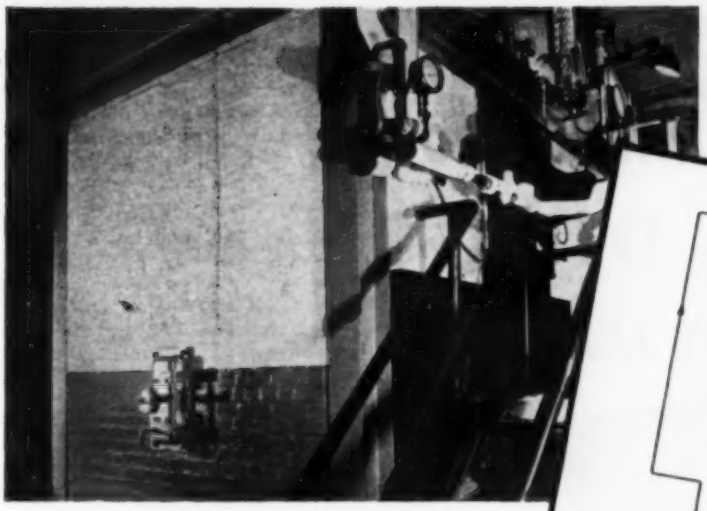
While working as high man on the beet sugar house at Preston, Idaho, in 1921 a swinging derrick knocked him off a purlin above the pan floor and catapulted him onto a mound of freshly excavated earth 80 ft. below. A local chiropractor adjusted a few dislocated joints in the neck and presently he was back on the job.

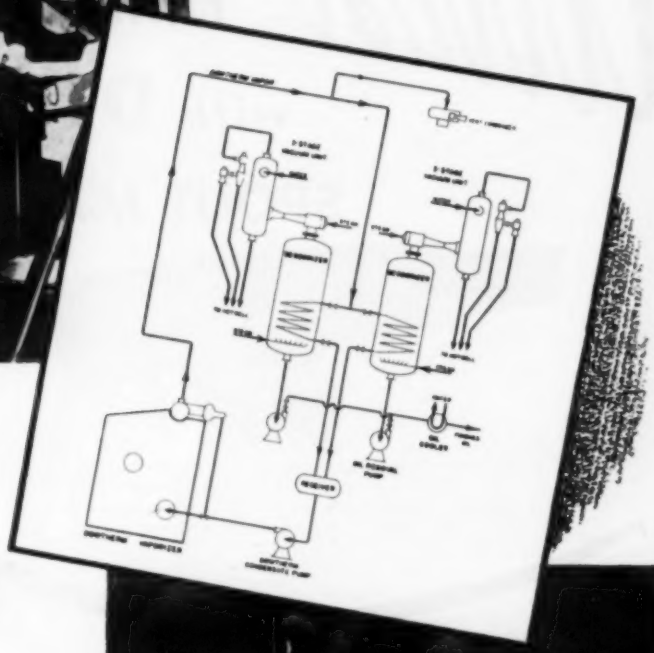
Steel erection on our Florida plant, west of the Hialeah race tracks, continued during the heavy flood that came down from Lake Okeechobee. Under the place where Chuck worked the water was seven feet deep. There is no record of any fall there but Chuck explains that there were rumors of alligators floating in the Florida waters.

A few years ago he was tuning up his car preparatory to a vacation trip. He was packing the fishing tackle into the rear when a wild, rum-soaked driver rammed him. The repairs to his car cost more than the surgeon although it took Nature and the weekly insurance benefits two months to get him back to the refinery.

THE WIZARD of the electric shop has a mascot in the person of a tiger-striped tom cat. He was born in the electric shop in '36 and the boys baptized him "Magee." Magee has a friendly character and is quick on the trigger. One day he was taking a nap on the window sill of the shop, which was then located on the seventh floor. A pigeon flew past the window. Magee's quick eye caught a glimpse of the pigeon and, under a reflexive impulse, he made a leap for the bird. He landed seven stories below and vanished. A few days later the boys were about to chant a solemn requiem for the repose of Magee's soul when suddenly he returned, a trifle lopsided but none-the-less able to assert his rights. Magee fortunately was equipped with the kind of structure that can stand the consequence of a thoughtless act.

THE 12-INCH SPOUTS that supply the high-speed 40-in. centrifugals plug solid with sugar after a period of disuse. Near at hand there hangs a coil of hose which is used for maintaining cleanliness about the place. Last week the operator (a "war baby") threw the coil on the floor in front of the centrifugal, peeled off a spiral or two, stepped into the middle of the coil and proceeded to squirt hot water into the spout to melt the sugar. Suddenly the plug let go and the operator reflexively dropped the hose and yanked down the spout gate. The hose fell into the basket





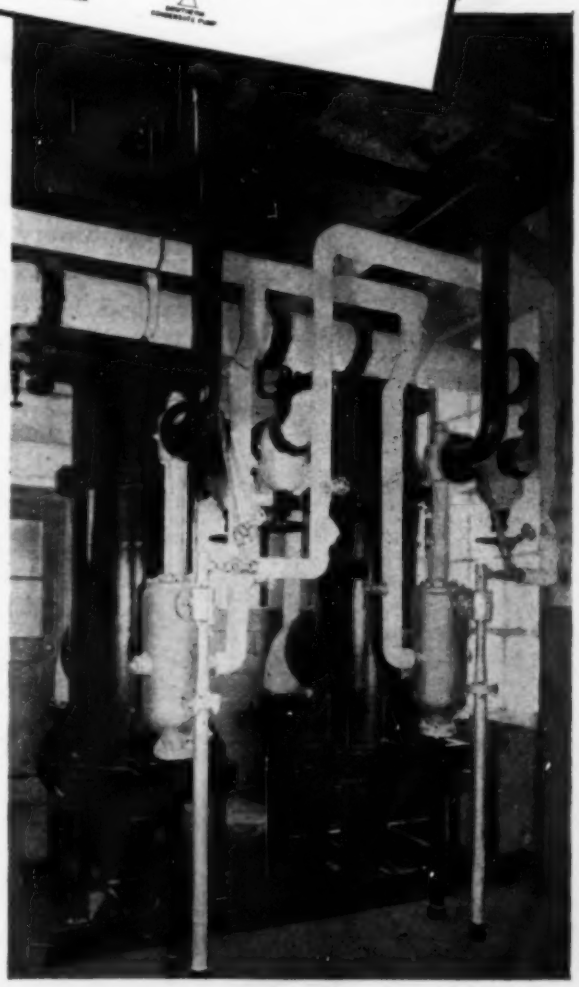
HIGH VACUUM OIL DEODORIZATION

Temperatures of 400°F. and upwards, coupled with high vacuum, offer the optimum conditions for deodorization of edible oils and many inedible oils. Where continuous operation is not feasible, due to frequent changes of oil types in process, batch operation is the logical selection.

A good example of batch processing is the Glidden Company's Durkee Famous Foods Division plant at Elmhurst, Long Island, which has been in operation for several years.

The processing temperature in the deodorizing towers is 450°F., heat being supplied by a Dowtherm Vaporizer operating at 560°F. and 15 lb. gage. Deodorization is completed more rapidly than at lower temperatures with resultant steam savings and a highly uniform product of excellent quality is produced. A vacuum of ¼ in. mercury absolute pressure is maintained on the system by two three-stage steam jet air ejectors.

Foster Wheeler designs and builds complete processing plants for batch deodorization . . . . from process design to unit operation.



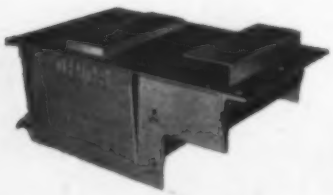
FOSTER WHEELER CORPORATION
165 Broadway New York 6, N. Y.

FOSTER WHEELER

Arrest TRAMP IRON with DINGS SPOUT MAGNETS

The Dings Type L Spout Magnet is designed to provide maximum protection for crushers, grinders, etc. Comes equipped with safety gate for automatic discharge when current is interrupted.

The Dings Type LA Alnico Spout Magnet is permanent, non-electric, and won't lose its magnetism. Magnet hinged for easy removal of iron. Non-magnetic spout extensions available.



Dings Heavy-Duty Spout Magnets provide High Intensity selection of ferrous from non-ferrous materials. Iron is attracted to a step in the magnet face. Current interruption raises safety gate for automatic discharge.

DINGS High Intensity Spout Magnets provide maximum protection of machinery against tramp iron, eliminate explosions and fires caused by sparks, and to help produce iron-free products. Dings Spout Magnets are a combination of the finest materials available and a wealth of manufacturing experience accumulated during more than 40 years' service to industry. Investigate Dings Spout Type, Pulley, Drum, Suspension and other type magnets. Write now for illustrated bulletins.

DINGS MAGNETIC SEPARATOR COMPANY
505 Smith Street, Milwaukee 7, Wisconsin

For Laboratories and Prospectors
Very powerful Alnico Horseshoe Magnet. 2½" wide and 3" high. Pole bases ¾"x ¾". Price will be sent on request.

Dings
"HIGH INTENSITY"

and wound itself around the spindle at 1700 r.p.m. In a flash the coil closed in on the operator's legs and spun him head over heels. Providentially the hose disengaged itself from his legs and continued to wind till it pulled off its moorings. Loss to the House: one hose. Profit to the operator: experience.

AN AGGRAVATION that annually besets the steam plant crew is the cleaning of the tubes. This is especially so in process plants where condensates without notice may bring contamination into the feed tank. A paper mill in Carolina was equipped with the style of superheater tubes that have a sharp forged return bend and these had become coated with a deposit. An enthusiast came on the job with one of those flexible shaft cleaners which can clean anything—almost! Boldly he inserted the head into the tube at its inlet in the steam drum and proceeded to play out rotating wire as the head advanced into the tube. After he had supplied wire enough to equal the length of the tube he inspected the steam header but the cleaner head had not arrived. However he had plenty of wire as well as confidence and so he continued to feed wire into the tube. When his length was exhausted he investigated and found his wire coiled up in the furnace. The cleaner head had bored a hole through the forging at the bend.

HORSELESS CARRIAGES originally accomplished locomotion by means of a pair of steam-actuated piston rods stomping onto the ground in imitation of the legs of a horse. Stationary engines measured in horse-power were mounted on stone foundations and when this crude structure was replaced with a cast iron bed, the form and decoration were made to resemble ashlar masonry. Hero was not fettered with the tradition of the intermittent power transmission device of the horse but it required 2,000 years to develop his "test-tube" effort into the practical machine of Parsons. When iron columns made their appearance they had to look like stone pillars capped with ornamentations of Grecian origin. The pioneer skyscrapers were oversize houses until Sullivan of Chicago made the "form follow the function."

MASTER DISTILLER, Señor Alvaré, announces a new remedy for colds. He simply stops smoking. When the cold is gone he resumes the habit in order to have a remedy ready at hand for the next attack.

PRIDE OF ACCOMPLISHMENT offers a spur to perfection. An "exterminating engineer" was describing in animated manner the excitement of the chase after cockroaches. At the dinner table at home he recounts to the family the activity of the day. He bursts with the enthusiasm of the hunter. Bagging the long-legged cockroach requires skill and strategy of the same order as is demanded by the alert and nimble-footed deer. The family swells with pride when the head man brags about an especially wily one who succumbed to superior wit.

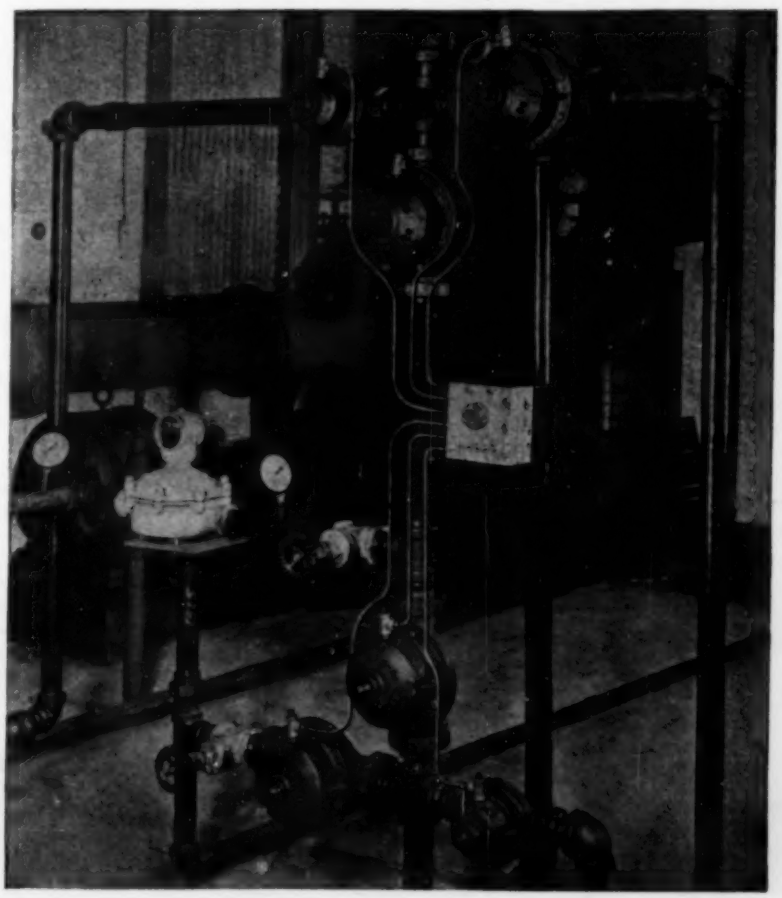
Not Acids...Alkalies...Abrasives nor Suspended Solids can Corrode, Abrade or Jam this

NEW DIAPHRAGM VALVE

McALEAR NO. M-1455 Corrosion and Abrasive Proof Diaphragm Valve. Pressures to 150 lbs. Temperatures to 150° F. Sizes ½" to 6"

This valve—not yet 1 year old—has already replaced more expensive valves in a goodly number of chemical plants, industrial plants, mines, sewage disposal plants, water works, paint factories, paper mills, food processing and other industries. It has proved practically indestructible in service with upwards of 100 acids, alkalies, abrasives and suspended solids.

Below: PILOT OPERATED TYPE controlling flow rate, backwash and rinse cycles in Mid-West industrial plant



Trouble-Free

THIS VALVE cannot freeze in outdoor service—has no stuffing box—requires no repacking. It does not depend on metal-to-metal contact for closure. Hence *cannot* leak and *never* requires reseating. Positive shut-off is provided by diaphragm—*even* when solids are trapped on the seat.

Installable *in any position* without danger of leaks. Special types may be operated from remote points by air or water pressure, controlled by automatic time-clock or pilot. For Diaphragm Valve Bulletin giving complete data, write Automatic Control Division, Climax Industries, 1939 S. Western Avenue, Chicago 8.

CLIMAX ENGINEERING COMPANY

WELDED TANKS
BOLTED TANKS
SEPARATORS

McALEAR controls

PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE

for STEAM, WATER, AIR, OIL—GAS

NAMES IN THE NEWS

J. V. Hightower

F. C. Whitmore

R. M. Crawford

John V. Hightower has joined the staff of *Chem. & Met.* as assistant editor and Washington correspondent. For two years he has been associated with the Petroleum Administration for War. After graduating from the Chemical Engineering Department of the University of Texas and taking graduate studies at Rice Institute, Mr. Hightower served in various engineering positions with Magnolia Petroleum Co., Humble Oil & Refining Co., and M. W. Kellogg Co. In 1941 he joined the editorial staff of Gulf Publishing Co. and remained in that position until he transferred to PAW.

David W. Harris, of Shreveport, La., has been elected president of the Universal Oil Products Co.

Alexander Schwarcman, chief research chemist of Spencer Kellogg & Sons, received the Jacob F. Schoellkopf memorial medal award of 1945 on May 25. The award was made by the Western New York Section of the American Chemical Society for his contribution to the processing, refining and modification of vegetable oils.

M. Herbert Eisenhart, president and general manager of the Bausch and Lomb Optical Co., has been elected chairman of the Board of Trustees of the University of Rochester to succeed **Edward G. Miner,** president of the Pfaudler Co., who resigned May 12 at the board's annual meeting.

C. E. Davis, general manager of the manufacturing department of Shell Oil Co., New York, has been elected a vice president to succeed **J. F. M. Taylor** vice president in charge of manufacturing, who has resigned.

Lewis Larrick has been appointed textile technologist on the research staff of the Institute of Textile Technology, Charlottesville, Va.

Frank C. Whitmore, dean of the School of Chemistry and Physics of the Pennsylvania State College, has been selected the thirty-fourth Willard Gibbs Medalist for his outstanding contributions as an organic chemist and his vigorous leadership in many organizations devoted to the advancement of chemistry for national benefit. The presentation will be made by the Chicago Section of the American Chemical Society at their September meeting.

William C. Rodgers, former works engineer of the Bakelite Corp., Bloomfield, N. J., has taken the position of director of research and development with the Gray and Foster Engineering Co., Brandon, Vt.

John A. Comstock has been appointed director of research and metallurgy for all divisions of H. K. Porter Co. He will be in charge of the central research and testing laboratory located in Pittsburgh.

Samuel Moment, chief of Bonneville Power Administration's market analysis section, has been temporarily appointed to the Surplus Property Board to supervise recommendations for the disposal of more than 50 aluminum plants. Mr. Moment will conduct studies of economic and marketing problems relating to the government-owned plants in the Pacific Northwest.

Henry D. Noll has been made manager of the project analysis department of Houdry Process Corp., Wilmington. Just prior to coming to Houdry, Mr. Noll was in New York with the manufacturing department of Socony Vacuum Oil Co. on special wartime assignments.

Charles Holloway Boardman, III, is now engaged in a Chemical Warfare Service mission for the War Department in China. Captain Boardman received his bachelor's degree in chemical engineering in 1940 from the Ohio State University.

Robert M. Crawford, of Durez Plastics & Chemicals, North Tonawanda, N. Y., has been named vice president of that organization. Mr. Crawford received his chemical engineering degree from Carnegie Institute of Technology.

William F. Zimmerli has announced the establishment of a private advisory service to the chemical manufacturing and consuming industries.

Raymond B. Seymour has resigned his position as group leader at the Central Research Laboratories of Monsanto Chemical Co. to accept an appointment as director of the Chattanooga Institute of Industrial Research.

George Walker is on leave of absence from the Warner Co. and is heading the Chemical Plant Branch, Engineering Section, Plant Utilization Division of the Reconstruction Finance Corp.

Shou-Chung Wu, head of the Analytical Chemical Laboratory, Ministry of Economic Affairs of the Republic of China, is spending a year's leave of absence studying the operations of an American analytical and testing laboratory. His hosts are Skinner & Sherman, Boston.

George W. Gleeson, professor of chemical engineering and head of the chemical engineering department at Oregon State College, is now dean of engineering.

C. Lalor Burdick has been appointed chairman of the board of Cia. Mexicana de Explosivos, which operates a dynamite plant in Mexico, and chairman of the board of Du Pont, S.A., general sales office for Du Pont products in Mexico.

A. F. G. Cadenhead, director of new product development of Shawinigan Chemicals, Ltd., was awarded an honorary degree of doctor of science by Laval University of Quebec on June 4.

How ya' gonna keep up with a gang like that?

Men on the firing line are depending on us for the things they need. There is only one way we can keep up with the men fighting so desperately for a quick knockout . . . that is to step up our purchases of War Bonds.

Don't wait—buy an EXTRA Bond today—and *keep* it!

CSC

COMMERCIAL SOLVENTS

Corporation

17 East 42nd Street, New York 17, N. Y.

DO YOU GET *All around* SATISFACTORY PERFORMANCE?

THE ABOVE INSTALLATION
5,900 CFM 345 RPM
20 lbs. maximum pressure

When you invest in Roots-Connersville Rotary Positive Gas Exhausters and Boosters, you get all five of the following characteristics which assure all-around satisfactory performance:

1. **Engineered-to-the-job Design**
2. **Economical Operation**
3. **Minimum Attention Requirements**
4. **Extra-long Life**
5. **Sustained High Efficiency**

The fundamental simplicity and efficiency of the Rotary Positive Displacement Principle is so effective that it is unrivaled for applications calling for moderate pressures, constant or variable, at slow operating speeds. Further backing up this inherent efficiency are the construction refinements and precision workmanship which Roots-Connersville has constantly built into their Rotary Positive air and gas handling equipment for over 90 years. Built for capacities up to 50,000 CFM.

ROOTS-CONNERSVILLE BLOWER CORP.
ONE OF THE DRESSER INDUSTRIES
506 Illinois Avenue, Connersville, Indiana

WRITE FOR BULLETIN 32-33-B-12

Roots CONNERSVILLE SINCE 1854 — *Rotary Positive* GAS PUMPS *and* BOOSTERS

Arthur Terry, head of the Dorr Company's contract engineering division has been appointed by the Foreign Economic Administration to administer that agency's rehabilitation activities in Holland and Netherlands East and West Indian possessions.

William LeRoy Parker, a graduate of the University of Delaware, has been appointed Hercules Research Fellow in the Department of Entomology at the University of Delaware.

Robert W. Cairns has been appointed assistant director of research in Hercules Powder Co.'s research department and **Raymond F. Schultz** has been named director of the company's experiment station. Dr. Cairns has been with Hercules 10 years and Dr. Schultz joined the company in 1941.

Norris Boehmer and **Clarence Barbre,** formerly operating superintendents have each been advanced to the rank of manufacturing superintendent at Monsanto Chemical Co.'s plant at Monsanto, Ill.

C. C. Anderson who has been engineer in charge of the helium plant of the Bureau of Mines at Exell, Tex., has been appointed assistant chief in Washington of the Petroleum and Natural Gas Division of the Bureau. **H. C. Fowler,** who formerly held that post, is now serving as supervising engineer of the Bureau's Petroleum Experiment Station at Bartlesville, Okla.

Ki Williams, plant manager of the acetate rayon plant of E. I. du Pont de Nemours & Co., at Waynesboro, Va. for the last four years, has been transferred to Wilmington as assistant to the director of acetate rayon production.

Henry V. Moss has been transferred from the research laboratory of Monsanto Chemical Co. at Carondelet, Mo., to Anniston, Ala., as supervisor of inorganic research. All research activities at Carondelet have been moved to Anniston to improve coordination of the sections.

William A. Zobel has joined the staff of Battelle Memorial Institute, Columbus. Dr. Zobel will be engaged in research in organic chemistry.

J. C. Hackney, formerly assistant professor of chemistry at Denison University, Granville, Ohio, has been named to the research staff of Battelle Memorial Institute, Columbus, and assigned to its division of organic chemistry.

Max A. Lauffer, associate professor of physics at the University of Pittsburgh has received the 1945 Eli Lilly & Co. award to the oustanding young scientist in the field of biochemistry. Selection of the award of $1,000 and the bronze medal was made by a committee representing the American Society of Biological Chemistry and the American Chemical Society.

David Gordon, recently chief engineer for the Interchemical Corp., has joined the

APPROVED PROTECTION

AGAINST CONTAMINATED AIR from

- PAINT SPRAY VAPORS AND MISTS
- WELDING AND CUTTING FUMES
- MOLTEN & BURNING METALS FUMES
- TOXIC DUSTS

M·S·A Airline RESPIRATORS

Above, the Airline Respirator with Half-Mask type Facepiece.

Below, the full All-Vision Facepiece, with wide-angled contoured lenses.

Officially approved by the United States Bureau of Mines, the M.S.A. Airline Respirator furnishes lightweight and comfortable respiratory protection against many hazardous classes of air contaminants. The Respirator is available with the popular Half-Mask type Facepiece, or with the All-Vision Gas Mask type Facepiece for use where protection for the face and eyes is also required.

Double exhalation valves are a special feature of each facepiece type, providing very low resistance to air flow. The complete assembly includes facepiece, corrugated supply tube, cartridge filter, quick-release connection, "bump-proof" control valve and air hose with couplings.

Write for the details on this widely-used respiratory protection equipment!

MINE SAFETY APPLIANCES CO.
BRADDOCK, THOMAS & MEADE STREETS PITTSBURGH 8, PA.
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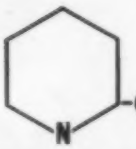

2-ETHANOLPYRIDINE

PURITY	(Minimum) 95%
MOLECULAR WEIGHT	123
BOILING POINT: At 10 mm. Hg.	117°C
At 760 mm. Hg. with decomposition	235°C
SOLUBILITY: Water	Miscible
Aliphatic hydrocarbons	Slight
Aromatic hydrocarbons	Miscible
Alcohols, ethers, ketones	Miscible

USES: The manufacture of pharmaceuticals, insecticides, fungicides, rubber accelerators, anti-oxidants, disinfectants, lubricants, and for numerous organic syntheses. The solubility properties of 2-Ethanolpyridine suggest its use as a coupling or blending agent.

APPROXIMATE WT. PER GALLON: 9 lbs.

Reilly COAL TAR PRODUCTS

A Dependable Source of Supply

for All Coal Tar Products

● With unusual production and delivery facilities, plants in 17 strategic locations, and offices in major cities, Reilly offers a complete line of coal tar bases, acids, oils, chemicals and intermediates. Booklet describing all of these products will be mailed on request.

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Executive Offices: Merchants Bank Building, Indianapolis 4, Indiana

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Reilly COAL TAR PRODUCTS

★ 17 PLANTS *To Serve the Nation*

staff of Foster D. Snell, as director of engineering.

David F. Smith, director of research of Johnson and Johnson, New Brunswick, N. J., has been elected to the board of directors of that company. Dr. Smith, a graduate of the California Institute of Technology, joined Johnson & Johnson three years ago.

Marvin J. Rolstad has been appointed head of the Insecticide Division of the Michigan Chemical Corp. of St. Louis, Mich.

David M. Gans has been appointed technical director of the Quaker Chemical Products Corp., Conshohocken, Pa.

Stewart Clare, entomologist and biochemist, has joined the staff of the Midwest Research Institute, Kansas City, where he has been placed in charge of a project for the Standard Oil Co. of Indiana which deals with the use of oil solutions in controlling insects and fungi in plants and trees.

William H. Rauscher has been promoted from assistant to associate professor of metallurgical engineering at Rensselaer Polytechnic Institute, Troy, N. Y.

C. H. Doherty, Jr., formerly manager of the Belle Works of E. I. du Pont de Nemours & Co. has been made assistant production manager of the Ammonia Department with headquarters in Wilmington, Del. **E. R. Habicht,** assistant works manager at Belle, will succeed Mr. Doherty as works manager, and the new assistant works manager will be **F. A. Otto.**

M. A. Kimmel, a graduate of Massachusetts Institute of Technology, has been made head of the Adhesives Department of American Resinous Chemicals Corp. His new responsibilities will include direction of research and development in adhesives.

G. P. Vincent, manager of the Sales Development and Technical Service Department of the Mathieson Alkali Works, has been appointed to the newly created position of technical director. He succeeds **R. E. Gage,** who was director of research and development for Mathieson for 14 years and who has now been appointed technical advisor for the company.

Carl M. Marberg, organic chemist, has jointed the staff of the Midwest Research Institute of Kansas City, Mo.

Lillian H. Hammond has left Hardy Metallurgical Co. to join the research and development staff at Sherman & Co., New York.

Frederick T. Wall, associate professor of physical chemistry at the University of Illinois, has been announced the winner of the $1,000 American Chemical Society prize in pure chemistry for 1945. The ACS prize, provided by Alpha Chi Sigma, is made annually and this year

Metals Need Alkalies

Metals are basic ... from the new light metals to the ferrous and non-ferrous, metals serve in numerous forms for a vast variety of uses ... Vital to metals are Solvay Alkalies and related products, proving that in war as in peace alkalies are indispensable!

CAUSTIC POTASH

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CALCIUM CHLORIDE

CAUSTIC SODA

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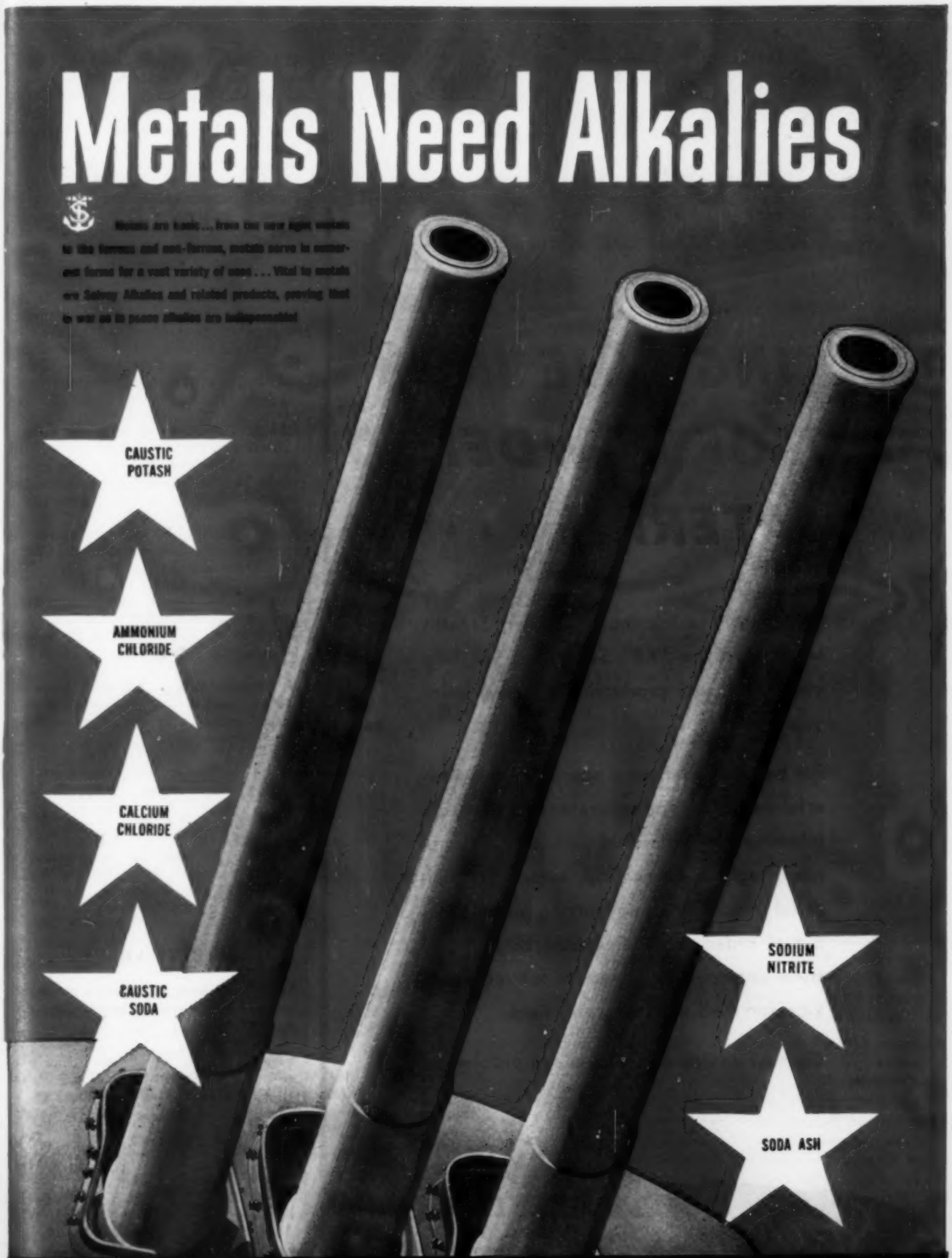
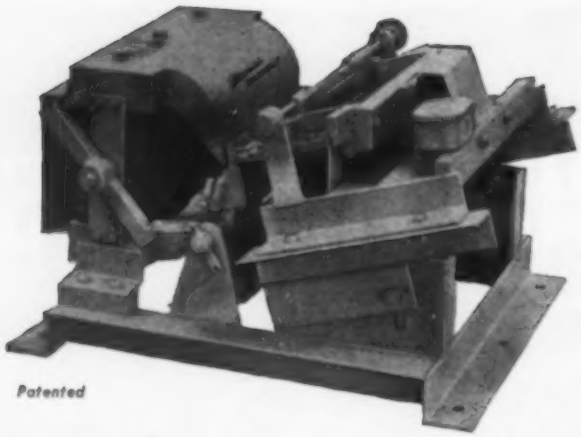
SODA ASH



SOLVAY SALES CORPORATION *Alkalies and Chemical Products Manufactured by The Solvay Process Company*



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GETTING FINE IRON OUT OF POWDERED MATERIAL • • • •

IF you have this tough problem, Stearns Magnetic Type "KB" Separators will help you smooth out production troubles, lower your costs.

For batch or continuous operation, this powerful deflector type separator offers a deep, intensive magnetic field . . . is small, compact, rugged, economical, automatic, foolproof, trouble-free, no working parts to get out of order . . . unified push button electrical control, with rheostats for regulating vibrator feed and magnetic field.

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•

Stearns

MAGNETIC MFG. CO.

SEPARATORS—DRUMS—ROLLS
CLUTCHES—BRAKES—MAGNETS

629 So. 28th Street, Milwaukee, Wis.

goes to Dr. Wall for outstanding achievement in research.

T. U. Blake has been named chief engineer of the B. F. Goodrich Chemical Co., Cleveland. Mr. Blake will head Goodrich engineering staffs in Niagara Falls, Louisville and Akron, and at company-operated synthetic rubber plants in Port Neches and Borger, Tex., and Louisville

Maxwell Gensamer, a staff member at Carnegie Institute of Technology for 16 years, became professor of metallurgy and head of mineral technology at the Pennsylvania State College on May 1.

Ross A. Baker, professor of chemistry in the School of Business and Civic Administration of the College of the City of New York, was elected chairman of the New York Section of the American Chemical Society at the section's annual meeting May 11.

John B. Data, formerly with the Lederle Laboratories, Inc., has joined the staff of Battelle Memorial Institute, Columbus, where he will be engaged in research in organic and pharmaceutical chemistry.

John E. Harvey, Jr. has been appointed assistant chief engineer of Rumford Chemical Works, Rumford, R. I.

Lars Onsager, associate professor of chemistry at Yale University, has been promoted to the Josiah Willard Gibbs professorship of chemistry.

C. Denman Connor has been promoted to the position of vice president and general manager by the Glassine Paper Co., Conshohocken, Pa.

Robert C. Thumser has been promoted to the position of plant engineer of Monsanto Chemical Co.'s John F. Queeny plant, St. Louis.

Raymond E. Birch has been appointed director of research of the Harbison-Walker Refractories Co., Pittsburgh, Pa. to succeed the late **Fred A. Harvey.**

OBITUARIES

Frank R. Eldred, 71, director of research for Reed & Carnick, Jersey City, died April 15.

Verne F. Curtis, 46, assistant chief engineer of International Minerals and Chemical Corp., died of a heart attack at his home in Evanston, Ill., April 25.

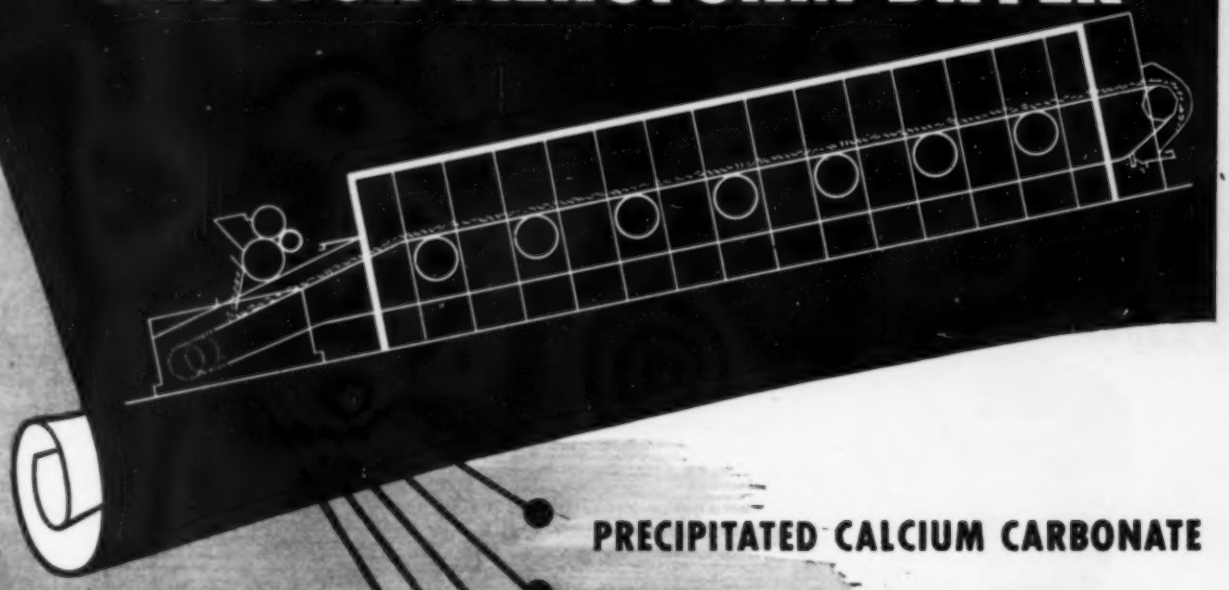
Guilford Duncan, 67, president of The Ludlow-Saylor Wire Co., St. Louis, died May 9.

Richard Milton Hollingshead, 77, president and founder of R. M. Hollingshead Corp., Camden, N. J., died at Pennsylvania Hospital, Philadelphia, May 15.

William L. Dankmyer, 67, assistant treasurer of the Allegheny Ludlum Steel Corp., Brackenridge, Pa., died May 27.

Five Typical Applications for one type

PROCTOR AEROFORM DRYER



All results of PROCTOR RESEARCH

PRECIPITATED CALCIUM CARBONATE

LEAD AND CALCIUM ARSENATE

MAGNESIUM CARBONATE

WHITE LEAD

ZINC OXIDE

These five chemicals are typical of the materials being dried in large scale commercial installations of the Proctor Aeroform Dryer, with the automatic Fin Drum Feed.

With this continuous system, the material to be dried is delivered to the hopper of the fin-drum feed in a wet-solid state, after filtering or some other means of mechanical dewatering. The material, in this wet-solid state, is pressed, by means of rollers, into the grooved surface of the internally heated, revolving fin drum which forms the feeding device for the dryer. In this way, the material is dried sufficiently to be discharged, from the drum, to the conveyor of the dryer, in the form of small sticks—of uniform thickness. Circulation of heated air *through* the bed of pre-formed sticks on the moving conveyor, makes possible rapid, uniform and thorough drying.

In each case where one of these drying systems is in operation, it is the direct result of Proctor research. Before being installed, it was determined in the laboratory, that this was the system most ideally suited to the product to be dried. Every step in the development of the system was taken with consideration for how it would effect the ultimate operation of the system.

Because of the accurate findings of Proctor research engineers—it was possible, in each case, to guarantee the performance of the system. The five chemicals named are typical of those being dried efficiently in only one type Proctor dryer. If drying is a part of your manufacturing process—let Proctor engineers consider your needs. Their recommendations may well save you hours of production time and reduce your costs materially. The system they recommend will be "tailor-made" in every respect to meet your product or plant requirements.

PROCTOR & SCHWARTZ · INC · PHILADELPHIA 20 · PA.

POPULAR

Getting workers to wear safety equipment is a constant problem, especially on "semi-hazardous" jobs such as light grinding, woodworking and spot welding. The Willson Protecto-Shield meets this problem because it combines *new comfort* and *smart appearance* with day-long protection for both front and sides of face and forehead.

COMFORTABLE

Both men and women appreciate these comfort features. Light weight. Tilting visor "stays put" in any position. Plenty of room for spectacles. Clear plastic visor free from optical distortion.

PRACTICAL

Exclusive "Slot-Lock" holds visor securely in place. Can't be jarred loose. Easily replaceable. Three visor-lengths —4, 6 or 8 inch. Two thicknesses—.030 or .060 inch. Two colors—clear or green. Visor and sweatband easily replaceable.

For help on eye protection problems, consult your Willson Distributor or write for information to Dept. CE-10.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

WILLSON DOUBLE

PRODUCTS INCORPORATED

READING, PA. U.S.A.

INDUSTRIAL NOTES

Macwhyte Co., Kenosha, Wis., has named Fred M. Sime district sales manager for the Pacific Southwest. Wm. J. Brett will serve the company in a similar capacity in the Pacific Northwest.

Hammond Bag and Paper Co., Wellsburg, W. Va., has elected M. E. Greiner vice president in charge of sales.

American Cynamid Co., New York, has announced the appointment of Reynolds G. Rockwell as advertising manager of the fertilizer division. He succeeds the late A. L. Tichane.

Wickwire Spencer Steel Co., New York, has placed Alvin F. Franz in charge of production at its plant in Buffalo with the title of general superintendent.

Pittsburgh Plate Glass Co., Pittsburgh, has appointed Erson V. Ogg director of the recently established industrial relations department. Clarence J. Moser has been named director of labor relations to replace Fred Keightley who died on May 12.

Proctor & Schwartz, Inc., Philadelphia, has elected John H. Senior vice president in charge of textile machinery sales.

Dow Chemical Co., Midland, Mich., has moved its branch offices in St. Louis to 3615 Olive St.

The Timken Roller Bearing Co., Canton, Ohio, announces that O. J. Horger formerly in charge of railway engineering and research has been appointed chief engineer of the railway division.

The Stow Mfg. Co., Binghamton, N. Y., has opened a service branch at 1401 Third St., San Francisco with Leon L. Allen in charge. Don S. Macauley, San Francisco regional representative will continue to make his headquarters in the Russ Bldg.

Link-Belt Co., Chicago, has placed the sales of its stoker division under the direction of Clarence H. Schuettenberg who is located in the Caldwell plant in Chicago.

The Baldwin Locomotive Works, Philadelphia, has formed a Canadian subsidiary known as Baldwin Locomotive Works of Canada, Ltd. W. N. Brownlie is managing director of the subsidiary and will open offices in Toronto.

The Goodyear Tire & Rubber Co., Akron, has awarded a contract to the Russ Engineering Co. for construction of a new plant at Gadsden, Ala., for the manufacture of soles and heels for footwear.

Westinghouse Electric Corp., Pittsburgh, has appointed Frank W. Godsey manager of the new products division to succeed G. H. Woodard who has been transferred to South Philadelphia to manage the aviation gas turbine division.

For lowest cost fume collection, especially zinc or lead, continuous 'round the clock operation with Norblo automatic bag type equipment should be considered first. For intermittent duty and smaller loads Norblo standard bag type equipment may be entirely satisfactory, with substantial saving on investment.

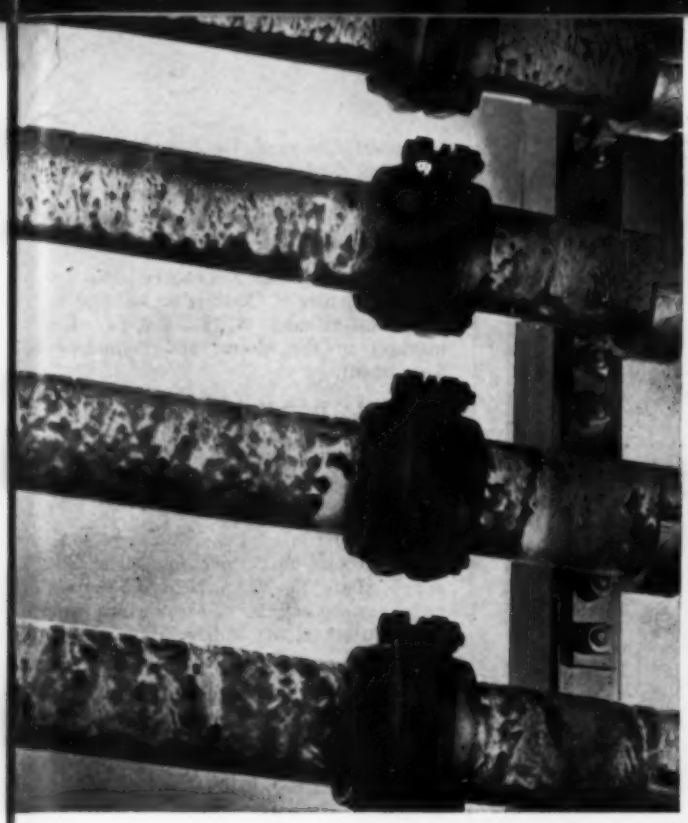
Norblo equipment also includes centrifugal and hydraulic dust collection, each of which has definite application in the mining, rock products and chemical industries.

Any Norblo fume or dust collection assures you advanced design, low cost operation and maintenance, and experienced, competent engineering. And if Norblo engineers act as consultants on any fume or dust collection problem, performance of Norblo equipment is guaranteed. Tell us your problem.

Norblo

THE NORTHERN BLOWER COMPANY

6411 BARBERTON AVENUE CLEVELAND 2, OHIO



GLASS PIPE *permits positive cleanliness*

Visit any plant where PYREX pipe is in use. While it is in operation you can see the product flowing through the pipelines. But shortly after operations are finished, it's more than likely the line will be sparkling clean . . . and you will be able to see that it's clean.

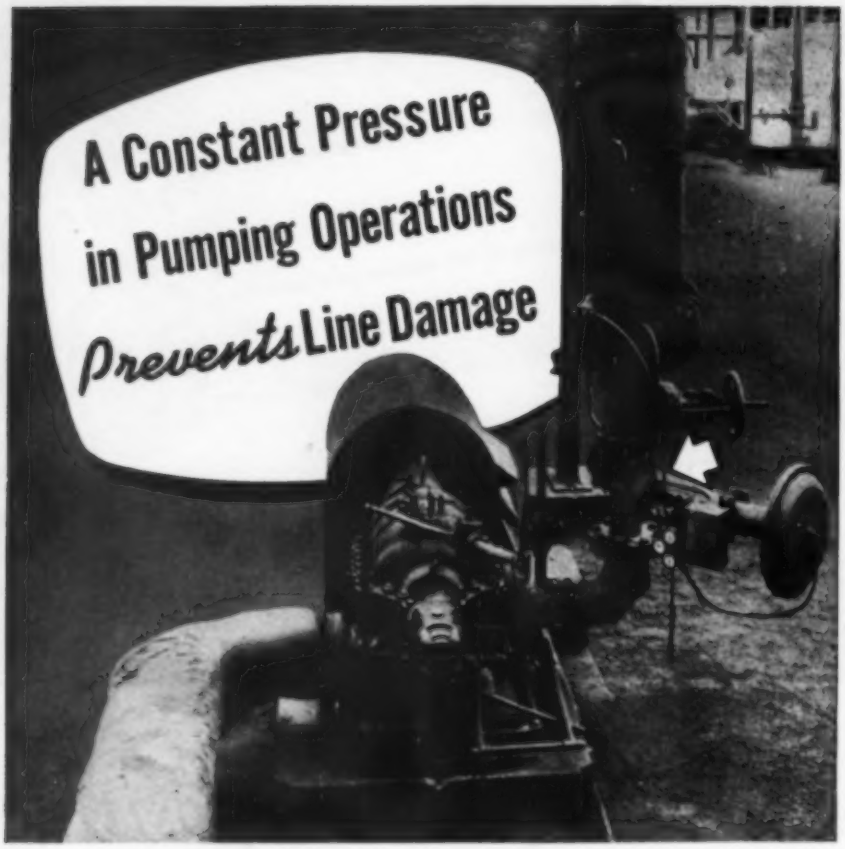
The hard, smooth surface of PYREX pipe minimizes the adherence of particles or deposits. Because of its high resistance to thermal shock it can be flushed with cold water, then with hot water or live steam

In addition to these outstanding cleanliness features PYREX pipe offers your product the protection that only PYREX brand glass can give. Because it is chemically stable and highly resistant to all acids, (except HF) corrosion and contamination are eliminated as threats to your product when you install PYREX pipe. Its ruggedness and ability to stand up under the most difficult processing conditions are proved by the miles of PYREX pipelines in service throughout industry.

For further information on how PYREX pipe can be used to advantage in your plant, write Industrial Sales Dept., CM-6.

CORNING GLASS WORKS
CORNING, NEW YORK

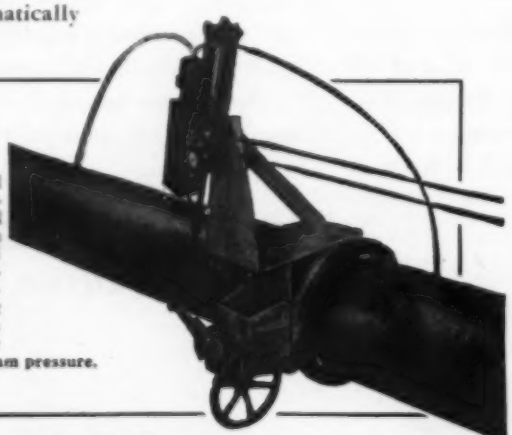
TROUBLE CAN'T HIDE BEHIND GLASS
Pyrex
BRAND
"PYREX" IS A REGISTERED TRADE-MARK
GLASS PIPE
AND INDICATES MANUFACTURE BY CORNING GLASS WORKS, CORNING, NEW YORK



The upstream or downstream pressure in a line can be controlled automatically by an R-S Butterfly Valve, equipped with an air diaphragm, oil or hydraulic positioner cylinder attached to the valve. If the line pressure decreases, the valve vane slowly closes until the predetermined line pressure has been reached, at which time the vane automatically reopens.

The use of an R-S Butterfly Valve as a main control valve provides unexcelled flow characteristics, simplifies performance, prevents water hammer and reduces maintenance. Operates for pressures between absolute and 900 pounds gauge.

Write for Catalog No. 14-B.



No. 501

125-pound American Standard R-S Valve equipped with declutching unit (patent applied for) which permits operation of the valve with the hand wheel. Only four to six revolutions of the hand wheel are required for complete opening or closure. The dotted lines indicate the piping necessary to maintain a constant upstream pressure.

VALVE DIVISION
R-S PRODUCTS CORPORATION
4823 Germantown Ave. • Philadelphia 44, Pa.

R-S Streamlined BUTTERFLY VALVES

Monsanto Chemical Co., St. Louis, has appointed Carl F. Graesser assistant sales manager for thermosetting materials. He is located in the company's office at Springfield, Mass.

Allis-Chalmers Co., Milwaukee, has appointed Charles F. Codrington assistant to the manager and A. E. Caudle sales manager of the blower and compressor department.

The C. O. Bartlett & Snow Co., Cleveland, has transferred John J. Watson from the engineering sales and service department in Cleveland to the sales office in Detroit where he will be associated with C. O. Bartlett.

The Foxboro Co., Foxboro, Mass., has added Harry D. Wagner to its staff of engineers serving the Cleveland area with headquarters in the Bulkley Bldg., Cleveland.

U. S. Industrial Chemicals, Inc., New York, has acquired the assets and business of Dodge & Olcott Co. Dodge & Olcott will continue to function under its own name and management headed by Francis T. Dodge.

Sterling Alloys, Inc., Woburn, Mass., has appointed Stanley G. Disque as its engineering service representative for Indiana. He is located in the Board of Trade Bldg., Indianapolis.

Republic Aviation Corp., Farmingdale, L. I. N. Y., has opened an engineering office at 42 Broadway, New York, as a permanent adjuct to its engineering department at Farmingdale.

The Clark Mfg. Co., Cleveland, reports that it will market its products under the name of the company. For 37 years the company has been producing steam specialties which were marketed by dealers with no reference to the Clark name.

Virginia Smelting Co., West Norfolk, Va., has named A. K. Scribner general manager to succeed Chas. W. Johnston who has become vice president. Chris F. Bingham has been appointed manager of the industrial sales department.

Crane Co., Chicago, has advanced Lucien W. Moore to the position of general manager of sales and branch houses to replace J. A. Dwyer who has been made vice president. F. J. Wilkey succeeds Mr. Moore as manager of the valve and fitting department.

Faesy & Besthoff, Inc., New York, has added Albert F. Weimer to its sales staff. Mr. Weimer will operate in the metropolitan and New England areas.

Fairbanks, Morse & Co., Chicago, has transferred John S. King from New Orleans to Chicago where he will serve as manager of the pump division.

The Vilter Mfg. Co., Milwaukee, has placed L. H. Fischer in charge of the Cincinnati branch with offices in the Ingalls Bldg. Mr. Fischer's territory includes the southern half of Ohio, Kentucky and parts of West Virginia and Indiana.

Proper **FINISHING...**

means **A QUICKER BEGINNING!**

Sivyer goes beyond the point of usual foundry practice in finishing castings for *greater* dimensional accuracy . . . correct size, shape and contour. Thus, Sivyer castings get on the job faster.

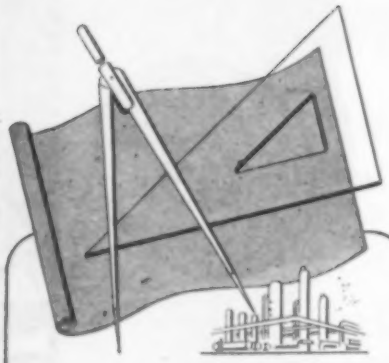
This means less handling . . . less processing of castings on your end. And once they are on the job, by the same token of taking time to make a sounder product, Sivyer castings stay there *longer.*

Dimensional accuracy is just another reason why critical buyers specify castings bearing the Sivyer diamond ◈ —the mark worth looking for. The next job—simple or difficult—give Sivyer a trial.

SIVYER STEEL CASTING COMPANY

MILWAUKEE ◈ CHICAGO ◈

ARMY E NAVY



Synthesis of Tomorrow's Opportunity

Never before in the history of production has industry been so ready and anxious to assimilate new ideas. War years have stored up new methods potentially valuable to industry and commerce. These new ideas and materials lie far and wide. They are the latest information which can be combined into thousands of new plans for industrial profit.

Busy industrialists must look to qualified special opinion to sort out the things they should know and to apply this knowledge to their own requirements. There are numerous firms with services and advice and mechanical facilities available but these seldom are coordinated for a joint operation.

Southwestern, with a quarter century of experience and successes behind it offers its services in chemical engineering and metallurgy and a manufacturing plant fully coordinated for equipment construction. This is a winner combination for clients. It saves time and lost motion. Also the Company has a line of standard time-tested equipment for your needs.

Write for information about the manner in which Southwestern can aid your future planning and construction. You may find that there is real profit in the Southwestern planning and follow-through.

●

ENGINEERS AND CONSTRUCTORS—
MANUFACTURERS OF
CHEMICAL, METALLURGICAL
AND REFINERY EQUIPMENT

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ENGINEERING
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CONVENTION PAPER ABSTRACTS

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RESEARCH, INVENTION AND PATENTS

INDUSTRIAL progress of this country and the high standards of living of our people have usually been attributed to the abundance of our natural resources. Few, however, realize that the Americans, to a greater degree than any other people in the world, are responsible for most of the epoch-making inventions of the past century.

Our entire social structure has been altered during the last century by inventors, who are the constructive builders of our civilization. These inventors opened new frontiers and opportunities for abundant life not by depriving people and nations of their property rights through robbery, trickery, and offensive warfare, but by creating new wealth in the form of new materials, new processes, new devices, new industries, more economical manufacturing methods, and new products.

Economic security for the people of this country was achieved in a large measure by inventions which have definitely extended gainful employment. Only one in six inventions has as its primary purpose the saving of labor; the other five-sixths of all inventions create employment, increase wages, increase wealth, decrease drudgery, improve working conditions, improve quality of product, and reduce the cost of goods. Even in 1940 fourteen million persons in this country were earning their livings in the manufacture, sale, and distribution of patented goods, and this number is much greater at present.

A. A. Potter, Purdue University, before Industrial Research Institute, Chicago, Jan. 25, 1945.

NATION IN THIRD PHASE OF RUBBER CRISIS

AMERICA is now in the "third phase" of its Global War rubber crisis and this summer will be the most critical period yet faced with respect to keeping essential traffic rolling. The rubber industry, along with the petroleum and chemical industries and the Government, licked the first phase, that of rubber supply, by the miracle of establishing synthetic rubber plants which this year will turn out a million tons of man-made rubber that is helping us win a war we might have lost without it. The second phase was the manpower shortage, and while it will con-

VITREOSIL
PIPES

Non-porous. Light weight. Electrically resistant at elevated temperatures. Free from metallic impurities. Homogeneous and of uniform quality. Highest temperature shock resistance of any ceramic material. Withstand severest chemical conditions. Ideal for conveying acid liquids and gases; reactions at high temperature; sintering; chloridizing; heat treatment; high vacuum; and controlled atmosphere techniques. Sizes up to 30" bore. For details write for Bulletin No. 7.

TUBING

Opaque, Translucent or Transparent. Has similar characteristics to Vitreosil Pipes but is available in smaller sizes. Produced in four qualities—(1) sand surface; (2) glazed; (3) satin surface; (4) transparent. Made in diameters and lengths to customers' specifications. For details write for Bulletin No. 9.

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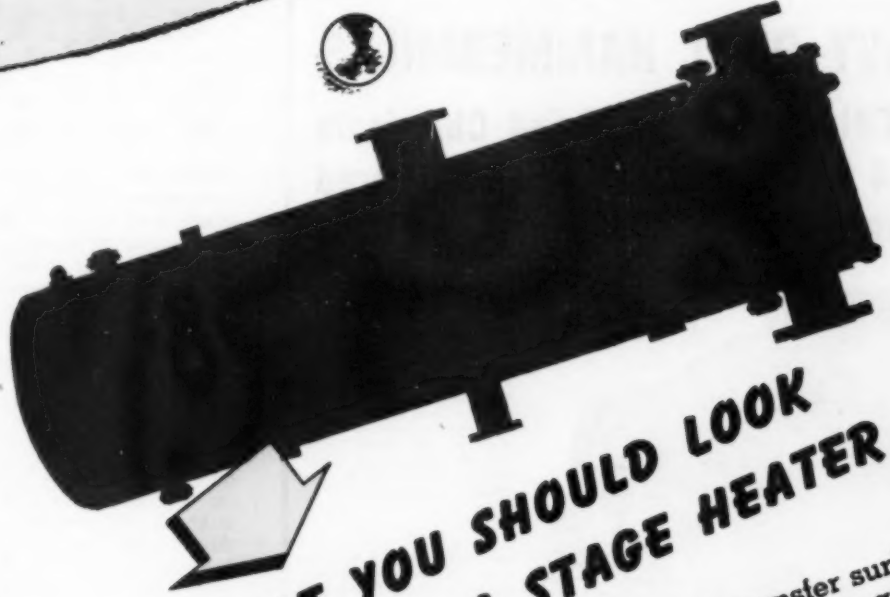
THE THERMAL SYNDICATE, LTD.
12 EAST 46th STREET, NEW YORK 17, N. Y.



WHAT YOU SHOULD LOOK FOR IN A STAGE HEATER

ONE OF A SERIES OF ADVERTISEMENTS DESCRIBING THE MANY TYPES OF G-R HEAT TRANSFER APPARATUS

In addition to the proper amount of heat transfer surface, a stage heater must have several features of design and construction to assure and maintain satisfactory operation and service.

Some of these features are:

Positive prevention of leakage at water heads.
Free expansion and contraction of tubes.
Ample support of tubes to prevent sagging and vibration.
Effective baffling of steam and air.
Utmost simplicity combined with sturdiness.
Convenience of access and ease of maintaining tightness of gasketed joints.

All these, and other advantageous features . . . many of them exclusive . . . are provided in the various types of G-R Stage Heaters for high, moderate and low pressures. Our Bulletin 277 describes these units in detail and explains how G-R Stage Heaters assure exceptional heating effectiveness, trouble-free service, and economical maintenance. Your copy of this informative bulletin will be sent on request.

G-R BUILDS ALL THESE UNITS FOR HEAT TRANSFER SERVICE . . .

Evaporators
Stage Heaters
Gas Coolers
Drain Coolers
Aftercoolers
Air Preheaters
Fuel Oil Heaters
Jacket Water Coolers
Process Heat Exchangers
Transformer Oil Coolers
Generator Air Coolers
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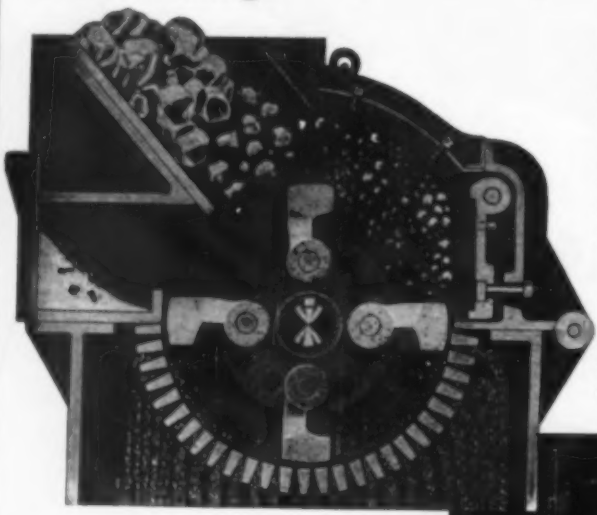
THE GRISCOM-RUSSELL CO.
285 Madison Ave., New York 17, N. Y.

GRISCOM-RUSSELL
Pioneers in Heat Transfer Apparatus

WILLIAMS

HEAVY DUTY HAMMERMILLS

FOR INDUSTRIAL USE . . . Grind Chemicals . . . Crush 4 feet Cubes of Rock . . . Shred Steel Turnings . . . . . .



Sectional view of Williams over-running hammermill with heavy liners and grinding plate for limestone and other hard material. Particular attention is directed to the grinding plate adjustment which assures uniform close contact of hammers and grinding plate at all times. Also note the metal trap which provides an outlet for the escape of tramp iron.

Williams Hammer Grinder direct connected to motor, all mounted on heavy cast base. This type of drive is economical to operate and easy to install.

Reduces

ANIMAL . . . MINERAL
VEGETABLE MATTER

Capacity from 50 pounds to 300 tons per hour

• Williams is the world's largest organization of crushing, grinding and shredding specialists and have developed standard machines for the reduction of practically every material whether animal, mineral or vegetable. Capacities range from 50 pounds to 300 tons per hour permitting selection of exactly the proper size for your work. Whether you wish to grind chemicals to 400 mesh, crush 4 feet cubes of rock or shred steel turnings, you can profit by Williams' experience.

THE WILLIAMS PATENT CRUSHER & PULVERIZER CO.
2706 North Ninth St. **St. Louis, Mo.**

Sales Agencies Include

Chicago 37 W. Van Buren St.
New York 15 Park Row
Oakland, Calif. 1629 Telegraph Ave.

Williams
PATENT CRUSHERS GRINDERS SHREDDERS

time to be with us for the duration, the industry has done a terrific job of combating it by sheer "bootstrap lifting," raising its production of heavy duty tires 30 percent in January over December, and exceeding the January goal by 13 percent.

The third phase is the shortage of component parts needed in compounding rubber and turning it into manufactured products. Carbon black is the best-known current shortage, being cited recently as the main reason why the tire industry was temporarily relieved of its seven-day-week schedule. But off and on, shortages of various of the textiles used in manufacture of rubber goods have been critical, too. The seriousness of the threat to both personal transportation and movement of essential foods and war goods on the home front this summer can be seen in the facts that allocations of civilian heavy-duty truck and bus tires for the second quarter of the year are only 50 percent of the number the ODT estimates as needed to keep essential rubber-borne traffic moving, while the total of passenger-car tires to be produced this year fall far short of the indicated needs. Surveys show that as of right now some 46,000,000 passenger-car tires need either recapping or replacement, whereas the total of new tires and recaps that can be supplied in all of 1945 probably will be less than 35,000,000, even at a generous estimate.

Joseph S. Hoban, The B. F. Goodrich Co., before Industrial Marketers of Cleveland, Cleveland, March 23, 1945.

VACUUM METALLURGY

THE RECENTLY introduced process for producing magnesium by the reduction of dolomite in a vacuum has brought about considerable interest in vacuum metallurgy. The knowledge acquired in this development can in general be applied to the melting and distilling of metals and alloys with the intention of purifying them or to improve their properties or to produce sounder castings. Experiments in this direction may be a complete failure if the phenomena observed in melting and evaporating metals in a vacuum are not taken into careful consideration.

The good heat conductivity of metals does not permit large temperature differences within the bath, even with excessive local heating. The principal law for vacuum evaporation of metals may be deduced herefrom, namely that vacuum evaporation is exclusively a surface phenomenon. Accordingly, to evaporate a metal rapidly in a vacuum we must create the largest possible evaporating surface since there is no boiling within the body of the molten metal. Atomizers may help to create a very large surface.

Metal vapor coming from the surface being evaporated has to pass to the cool condensing surface, which is located at a certain distance from the place where the vapor is produced. This movement presumes the existence of a pressure difference between that of the metal bath and that next the condenser surface. The volume of metal vapor is relatively large due to high temperature and low gas pressure. Accordingly, the velocity of the flow of the metal vapor is very high. Therefore, too, the open sections through which the vapors

Check List #2*

of properties which may suggest new applications of SONNEBORN PURIFIED HYDROCARBON OILS in your manufacturing processes

FOR SOME time, purified petroleum hydrocarbon oils have been replacing ordinary mineral oils, or oils of other origin, in the manufacture of various products, some new and some old. Analysis of the unusual characteristics of purified hydrocarbon oils often leads to their adaptation to meet specific requirements for which these oils are constitutionally well suited.

These characteristics, some of which are listed in the accompanying panel, indicate a wide variety of applications in many fields. They may suggest new uses for purified hydrocarbon oils — now commercially available — which may hold the solution to one or more of your manufacturing problems.

** This is the second in a series of bulletins focusing industry's attention on the possibilities of purified petroleum hydrocarbon oils. The next will appear in an early issue of this publication.*

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- ☐ Seal against moisture evaporation
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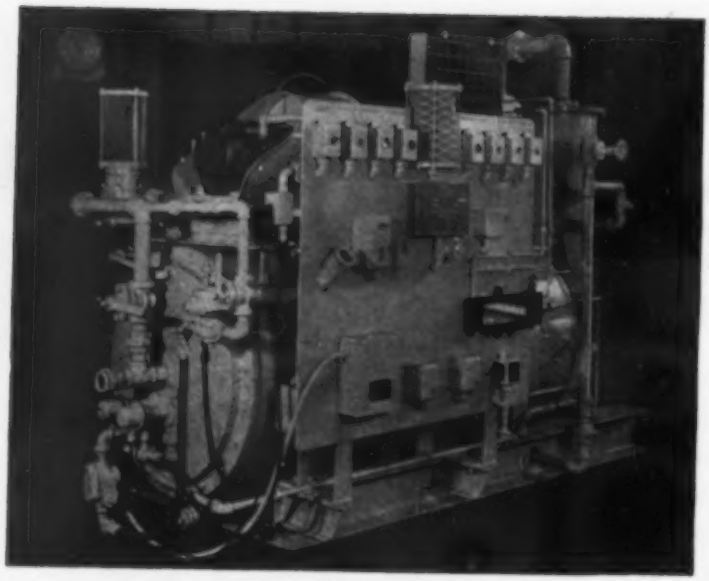

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pass have to be as large in cross-section as possible, and the distance between the bath and the condenser as short as possible.

Condensate is usually in the form of long dendrites which grow in the direction opposite to the direction of heat flow. The size of the crystals and their form depend upon the temperature of the condenser. In the presence of relatively large quantities of non-reacting residual gas, the crystals tend to be small. Loose, sometimes even finely divided, pyrophoric metal or metal powder, similar to "blue powder" may be obtained due to reverse reaction of the condensing metal with residual gas such as air. The coating of the crystal surfaces, which is generally an oxide or nitride, prevents the crystals from forming a solid, coherent mass. Frequently the first layer of the condensed metal is powdery as well as the last one because in the first and last phases of the evaporation much residual reacting gas comes in contact with proportionately little metal vapor. The ratio of metal vapor to residual gas determines the physical nature of the deposit.

The location of the triplepoint on the vapor pressure curve is important since it determines whether a metal can be condensed, as a solid, above the molten metal or whether refluxing will take place. Downward condensation is preferable in every case. A minimum pressure of 1.8 mm. Hg is required for the rapid flow of the metal vapor towards the condenser to ensure practical operation on a commercial scale. The vacuum has to be adjusted to the particular task; the indiscriminate use of a good vacuum may lead to complete failure when trying to melt a metal or when annealing alloys with constituents volatile at low pressures.

W. J. Kroll, consulting electrometallurgist, paper prepared for presentation at 87th general meeting of The Electrochemical Society, Atlantic City, April 12–14, 1945.

WARTIME STANDARDS OF CONSTRUCTION IN OIL REFINERIES

When the supply of certain materials first began to be critical, various governmental agencies requested the cooperation of industry in their conservation. At the same time, these agencies stressed the necessity for continuity of operation and safety of both equipment and personnel. It was realized that accidents to equipment would result in less production than planned or more equipment would have to be constructed to assure the required production. It was also realized that the personnel available for production would decrease. For this reason, safety of personnel was also a paramount consideration.

It was realized that the petroleum industry generally designed equipment for a life of ten or more years. Also, design was based on balancing repairs with a high normal service factor to obtain the most economical unit. It was felt that equipment being constructed during the war emergency might be designed for a much shorter life and the probability of more repair, with a very large saving in critical materials.

Application of this principle resulted in a number of major changes in design standards as well as numerous small changes. In some cases a reduction in

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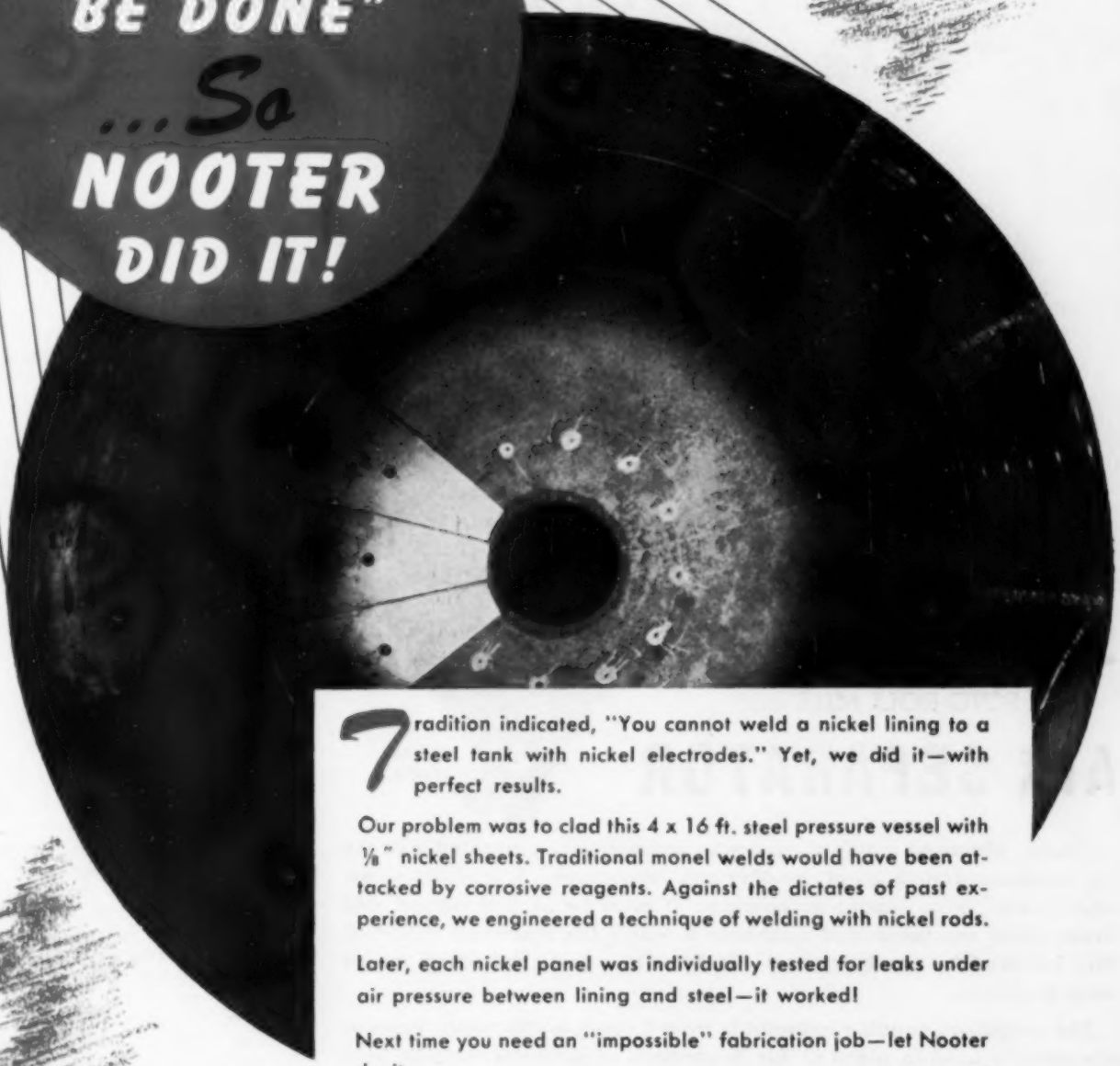

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corrosion allowance, without change in material, was employed to secure a shorter estimated life. In other cases less corrosion resistant materials were employed to obtain a shorter estimated life. In many cases, such material had previously been used and replaced by a more corrosion resistant material to obtain longer life. In many instances where pressure vessels were subject to severe corrosion, linings of ganister, reinforced concrete or acid-proof brick were substituted for alloy linings. Linings made of such material have a shorter life than alloy linings and generally require more frequent repair.

Simplification of equipment involved a much wider range of changes than was afforded by designing for a shorter life. By locating operating valves at lower levels or providing remote operating devices, some of the operating platforms could be eliminated. Those platforms which were used only for maintenance could frequently be spaced further apart by using low wooden scaffolds on them. Also they could frequently be reduced in width without seriously impeding the necessary maintenance work. Stairs for access to platforms used frequently by operators appeared essential but the use of ladders for access to the remainder of the platforms seemed feasible.

In many cases, prior to the emergency, exchangers, coolers, reflux and distillate drums, and similar equipment, were installed at high elevations. This resulted in much heavy structural steel work to support such equipment. In a great many cases it has been found feasible to locate this equipment at much lower elevations, much of it at ground level where no supporting steel is required.

In prewar practice large numbers of manholes were installed in bubble towers to facilitate inspection, cleaning and repairs. In some cases a manhole was installed at every plate level. In war time construction many of these manholes were eliminated. Removable sections were provided in the bell cap plates to permit access to all parts of the towers.

To avoid shutdowns and permit continuity of operations, equipment subject to excessive wear, corrosion or fouling, such as exchangers and pumps, was frequently duplicated in prewar construction. Much complicated piping with many valves was required to isolate and bypass individual pieces of such equipment. Much of this spare equipment was deleted in wartime construction since both the equipment itself and the valves required were on the critical list.

Instruments were one of the main bottlenecks in the refinery construction program and it became necessary to eliminate all instruments not absolutely required for satisfactory operation of the equipment.

To avoid a shutdown due to a utility failure, multiple sources of supply were often installed in prewar construction. These consisted of such things as looping stream lines, furnishing power through two or more circuits, providing fuel from several sources, etc. Considerable savings were made in wartime construction by the elimination of more than one source of supply.

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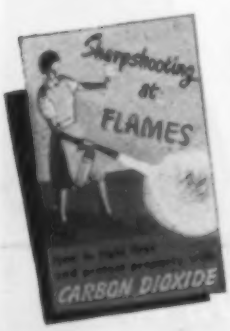

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Analyses of the principal items comprising the program do not indicate that a high standard of safety was sacrificed. Many of the items impose greatly increased costs on the industry. Some of the items require changes in procedures formerly used. Many of the changes involve more care on the part of the operator. This probably increases the possibility of human error. On the other hand, the essential features for safety are present. Probably the fairest conclusion is that the equipment is not quite as "foolproof" under wartime standards of construction as when it was built to prewar standards.

Franklin L. Newcomb, Standard Oil Development Co., before 33rd National Safety Congress, Chicago, Oct. 4, 1944.

THE FUTURE OF THE PLASTICS INDUSTRY

WHAT is the future of the plastics division of the chemical industry? There are many things that can help or hinder and a brief look at some of these factors might be in order. The industry will probably remain in a state of flux as long as the war effort dominates its activities, but we are already entering a "shakedown" period during which many of the "bugs" will be eliminated.

The average price of most plastics will play a big part in the extent to which they are utilized. The biggest cost factor is, of course, the price of raw materials—chemicals. The chemical industry can be of considerable help. Otherwise there may be a temptation on the part of some of the larger materials producers to manufacture more of their own important ingredients. A postwar price reduction of approximately 20 percent is indicated in most of the types of plastics except possibly for the older ones such as cellulose nitrate and phenolics.

Of course any expansion, either in the production of plastics materials or in their fabrication, will require additional investment. Most plants for the production of plastics materials require an investment of from 10 to 35c. per lb. of annual capacity depending on the type of plastic and how far back they go in the production of the essential raw materials.

No one can foretell what influence patents may have on the expansion of the plastics industry. There is no question but that there will be many patent conflicts which must be ironed out after the war. Temporarily, this may act as a restraining influence in some cases.

Other general influences will be the extent of government controls, export policies, the labor situation, population growth, and standards of living. All of these will, of course, influence industry as a whole.

Because of the tremendous wartime expansion it will probably be two or three years before vinyls and methacrylates find sufficient civilian outlets to utilize this capacity and warrant further increase. A 50 percent expansion is indicated in cellulose plastics.

Polystyrene is the largest enigma in the plastics industry today. Six to ten million pounds of polystyrene constituted the 1944 production compared with a capacity of 400 million pounds of styrene monomer—

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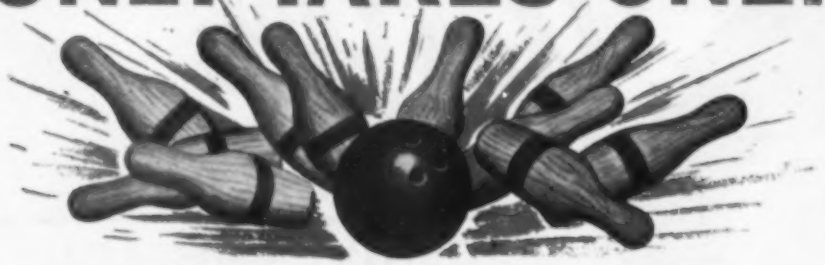

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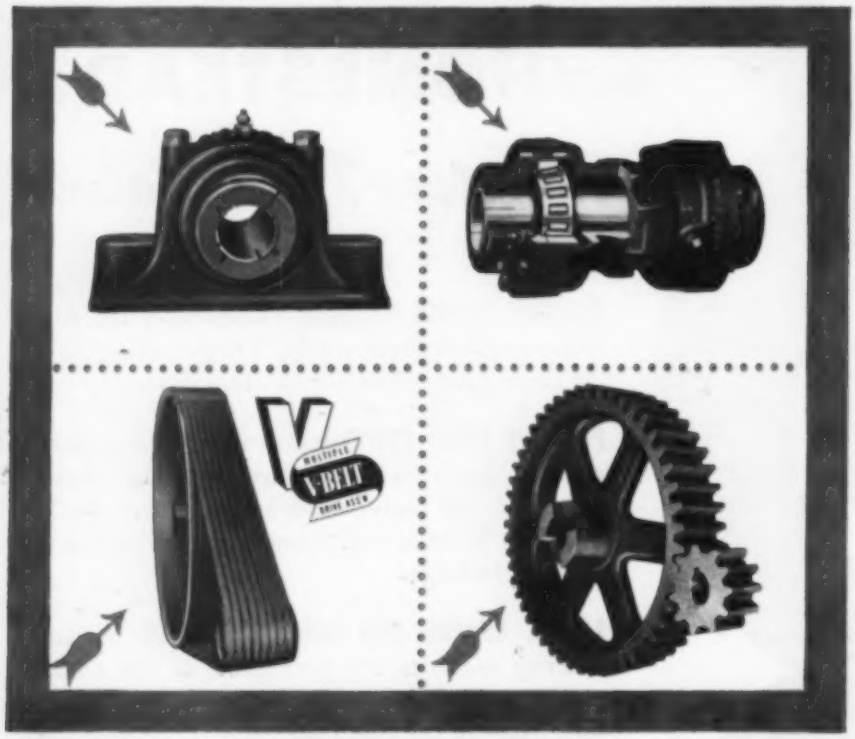

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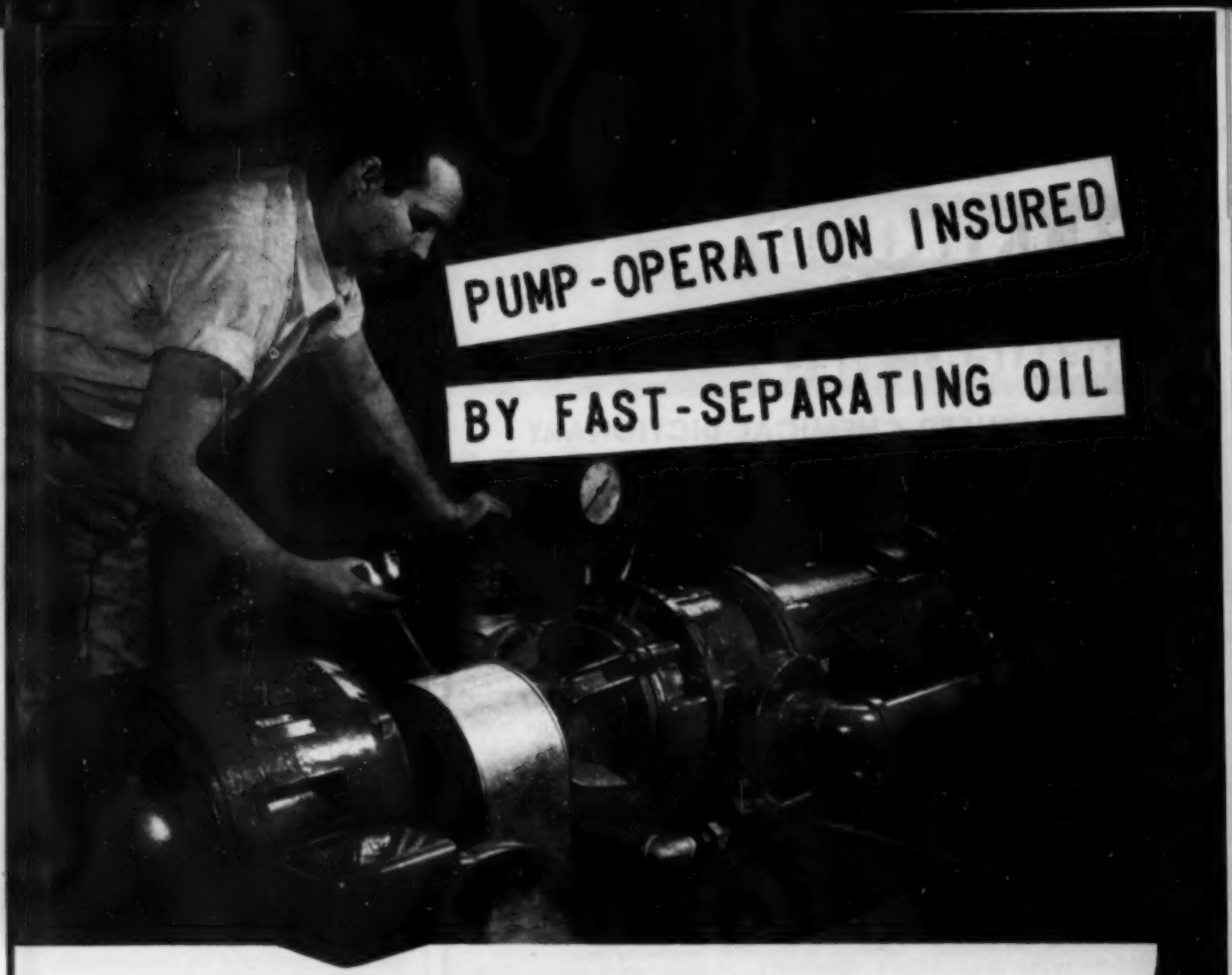
all tied up with the synthetic rubber program. Six months ago contemplation of this potential supply of plastics was enough to give anyone the jitters. However, sober reflection would search for the answers to the following questions: How long will this capacity be required for synthetic rubber? Will styrene monomer continue to be the necessary ingredient for buna rubber or will some other material be found more suitable? If so, can it be produced with the same equipment? If the full capacity is not required for the synthetic rubber program, how much will be released and how much of it will find its way into plastics? By the time this comes about, will some of the equipment be worn out and not likely to be replaced? How much of it will be obsolete? Even without restrictions, no one is likely to build a monomer plant today. There is even a hesitancy to build polymerizing capacity until we know the answer to the supply of monomer. Moreover, straight polystyrene as such, even though it may be priced postwar at 20 c. has limitations as to use. Many laboratories are working on improving the polymer mostly by copolymerizing styrene with other polymerizable materials. Some of these may fall outside the realm of plastics. Those that are used for plastics are likely to be in a higher price range.

It appears, however, that increasing quantities of polystyrene will be used and many predict an interesting competitive development between polystyrene and the cellulose plastics. A recent survey indicates that approximately 60 percent of the requirements of this type of plastic would be in colors. Starting with crystal polystyrene at a selling price of 20 c. per lb., it is possible that colors could be sold in the neighborhood at 27c. On the other hand, cellulose acetate in colors is likely to sell postwar at much lower than present levels. There is a difference of specific gravity in favor of polystyrene but the two materials should be fairly competitive.

Low pressure laminating resins are due for a large growth. At present, however, there is a surplus of producers of such resins and a dearth of fabricators. Many people are of the opinion that the profits will lie with the fabricators and not with the resins producers. Furthermore, better techniques of fabricating will undoubtedly be found. Experimental applications must be worked out and a distribution method established. This leads to speculation on what may happen to industry generally.

Prewar cars used about two pounds of plastics. If the automotive industry succeeds eventually in turning out 10 million cars per year this would represent 40 million pounds consumption at the rate of 4 lb. per car. This is only 5 percent of the present output of all plastics, and the applications do not include wire and cable insulation, interior panels, body and fender applications, or the plastic content of the lacquer. The automotive engineers would like to use 10 to 20 lb. of plastics per car, but from a practical point of view this will require much experimentation. This industry has been looking at low pressure laminates. However, the engineers say that from a structural standpoint, while they may be applicable in some cases the



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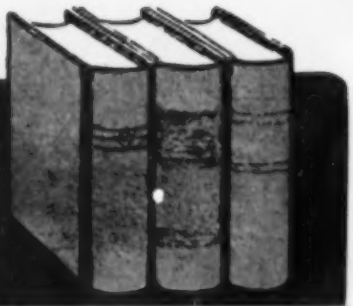

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cost of production is likely to be too high.

Many people are looking for a big outlet for plastics in the building industry, but this should be deflated somewhat. The present administration hopes for an annual national income of 150 billion dollars after the war. If so, this will be an increase of 50 percent over the prewar total. A healthy building industry, making up for lost ground due to war inactivity, should take about 10 percent of the national income, or 15 billions. About half of this would be in materials alone, or 7½ billions. Several authorities, who have attempted to make a study of plastics in building, doubt if the total value of plastics of all kinds and in all forms would exceed 2 percent of this 7½ billion dollars, or in other words—$150,000,000. Since most of the plastic would be in fabricated or semi-fabricated form, we would have to divide this by approximately two in order to arrive at the value of the plastics materials. Therefore $75,000,000 represents the maximum potential value of plastics likely to enter into building in the foreseeable future, and this is optimistic. It is, nevertheless, a sizable amount and approximates 25 percent of the value of all plastics produced in 1944.

Other fields to which we should look for healthy increases in the use of plastics would include aviation, television, telephone, domestic appliances, industrial, specialties, packaging, insulation, and toys and gadgets. Like the chemical industry, in the last analysis, plastics serve almost every one of the 72 basic industry groups listed by the Department of Commerce. These fields make up the widely ramified and diverse markets of the chemical industry and its offspring the plastics industry.

It is obvious that we in the chemical and plastics industries cannot solve all the problems of other industries. We cannot spread ourselves too thin, but we can inform ourselves to the point where we can give valuable aid to every company or group that strives to develop a better product and a sounder industry.

W. S. Landes, Celanese Plastics Corp., before Chemical Market Research Group, New York, March 2, 1945.

PREWAR RESEARCH BEHIND WARTIME DISCOVERIES

THE HOST of brilliant scientific discoveries that the war has produced were not miracles. They were the product of years of painstaking research, by highly trained scientists usually working in teams and utilizing the skills of numerous specialists.

The war has all but stopped the basic academic research which finds new truths and supplies new materials on which most of the industrial progress of the future depends. Years will be required before basic research activity again reaches its prewar level. This is a matter of great concern to the scientists and should be to the public, for only by years of patient research by trained and competent investigators can we maintain the high level of achievement in the field of science, on which is based our position of eminence among nations.

Roger Adams, University of Illinois, U. S. Rubber Broadcast, May 20, 1945.

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ENGINEERING SALESMANSHIP AND ENGINEERING TRAINING

THERE is a great deal of uncertainty and ambiguity surrounding the term "Engineer." Particularly is this true in the case of "Sales Engineer" because of the large number of industries which employ and will employ so-called "Sales Engineers" in their activities.

An engineer's work is characterized largely by rational processes, whereas some professional work, or the craftsman's work, is characterized largely by rule-of-thumb methods. Certainly the work of the sales engineer requires the application of the scientific method and rational processes. Only in this way can one engineer persuade or help another engineer, and that is what is involved in the sales engineer's work.

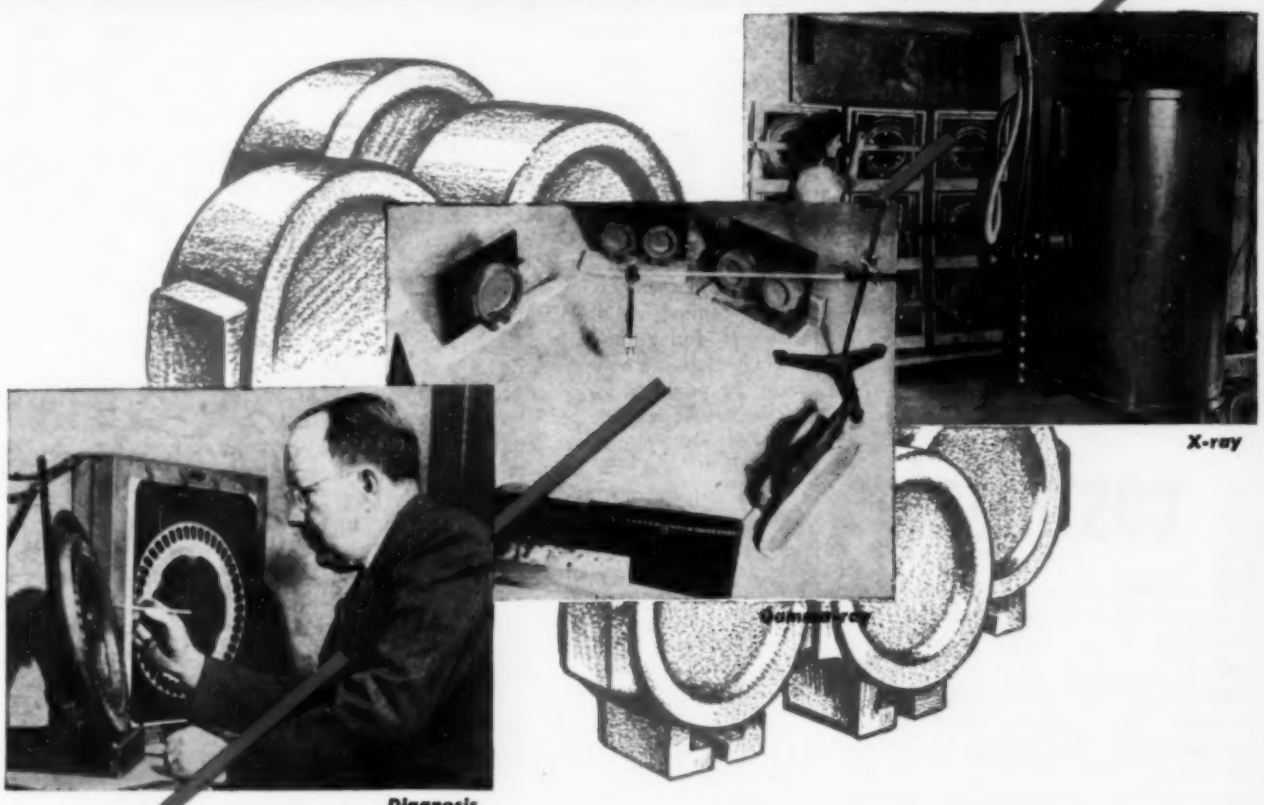
Consider this Sales Engineer. What must be his qualifications and characteristics? (1) He must be a capable engineer with a thorough knowledge of the manufacture and all possible applications of his products. (2) He must be a man or woman (not restricted to men) with a pleasing personality, be able to speak well, use good English, and, if possible, have some knowledge of contracts. (3) He must like people, have the ability to get along with people, win their confidence, respect and good will. In fact, he must have the ability to sell himself as well as the products and his company.

Although, according to several studies, sales engineering is continually growing as a source of employment, particularly for mechanical, chemical, electrical, administrative and petroleum engineers, possibly one of the reasons why some employers still do not look with too much favor upon the employment of such talent, is based upon the assumption that engineers in general do not have the personal qualifications to meet the public and establish the confidence, respect and good will desired. This assumption is due, no doubt, to the observation that so many in the engineering profession have been of the introvert type or have been so engrossed in the technical phases of engineering work that they have not developed the human qualifications necessary for getting along with people.

In practically every field and especially in the fields of chemistry, petroleum, plastics, etc., specializing has become necessary. Every new development requires more and more technical knowledge. More and more, it will become necessary that the sale of products of these industries will have to be "engineered" to the public by trained personnel with both engineering background and sales experience.

During the postwar period, the ability of technically trained men in industry will be on a much higher level because of the broadened experience of the engineers who have remained at home and solved the many problems of this war; intensified education given an unprecedented number as training for war service; the practical ex-

THREE KINDS OF "EYES"



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perience gained by many of these men in the service who will return greatly improved for their war experience.

As the result of all this there will be more trained men filling positions of production superintendents, directors of purchases, purchasing agents, etc. Surely these men are going to have more definite ideas as to what product qualities they need and the service and results which the supplier should furnish. More and more, it will require an engineer to sell an engineer.

How are we going to provide 60 million jobs? It is one thing to talk about 60 million jobs and a lot of loose talk has been coming out of Washington on this subject during the past weeks. But 60 million jobs can only be reached if products can be produced at prices at which they can be sold, and the products sold.

Federal projects are only temporary expedients and can only be regarded in that light and not as the answer to this fundamental problem. The cost of all such government expedients is distributed by taxes and a very large percentage of it borne by industry; whereas, if there is to be any permanent solution to this problem, it will have to come through private enterprise with an entirely different approach.

Private enterprise can and will solve its part of the problem provided it is given an opportunity to do so. It will require lifting or relaxing of extreme tax burdens such as excess profits taxes, accelerated depreciation allowances, and possibly some postwar refinancing for small industries, in order to permit it to expand, take advantage of new technological improvements, increase production and provide employment of more people. And how can such a program be initiated and maintained? Only by selling the products produced.

We have been spoiled in many essential industries during the war. We have had a sellers' market. With the cessation of hostilities, things will again have to be sold and, more than ever, intelligently sold. Many economists predict extreme competition in many lines, which will place a premium on salesmanship and sales ability.

On any such premise, the engineering salesman should come into his own in a manner never before approached in the history of our industrial development. In fact, he should become a necessity in many industries.

During the postwar period, therefore, the demand for graduate engineers of technical and sales ability will be greatly increased. The prestige of men with engineering training will receive great impetus and, as a result, such men will move along into positions of greater importance and responsibility at a more rapid rate than ever before. Many industrial concerns in an effort to develop rapidly capable talent of this character will in-

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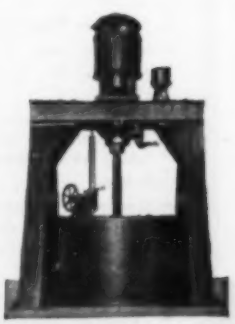

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The new and improved model of the mechanical age that is surely ahead of us during the postwar period will bring a greatly increased demand for war-developed, higher quality, higher performance products and war-developed, improved techniques and methods of application. There must be better educated, better trained personnel to explain and sell both.

Where can we find the men necessary to meet these demands except among the well grounded, well qualified sales engineers, trained in basic engineering, trained in the merits of his company's line of products, trained in the understanding of technical and practical problems of customers? The sales engineer will certainly be the man of the hour.

L. C. Welch, Standard Oil Co. (Ind.), before Engineering Society of Detroit, Detroit, Jan. 30, 1945.

FOREIGN LITERATURE ABSTRACTS

AMINO RESIN MOLDING POWDERS

APPLICATION of molding powders has developed to a considerable extent in the last 20 years, since such powders make it possible to manufacture objects with very complicated shapes. The first molding powders used were the phenol resins, but some of their disadvantages, especially the great difficulty of manufacturing transparent and clear-colored objects led to the study of other products. First experiments on condensation of urea with formaldehyde were carried out in aqueous solution without a catalytic agent. Condensation of urea or thiourea with formaldehyde is greatly influenced by the pH of the reaction medium, especially if the reaction takes place in the presence of acids. Briefly, preparation of resins by urea-formaldehyde condensation is carried out as follows: A primary condensation takes place in a neutral or slightly alkaline medium, which leads to the solution of methylol urea. A second condensation, which yields the polymerized products, always takes place in an acid medium, the necessary acidity being attained either by the addition of a suitable acid or by means of a substance capable of conversion into an acid by chemical or thermal means. Although each manufacturer uses his own particular methods for preparation of molding powders, there is a basic series of principles which applies to all the methods. Constant pH of the medium necessary in the first phase can be readily maintained by means of an alkali or alkali earth carbonate, especially calcium carbonate. Active carbon can also be used

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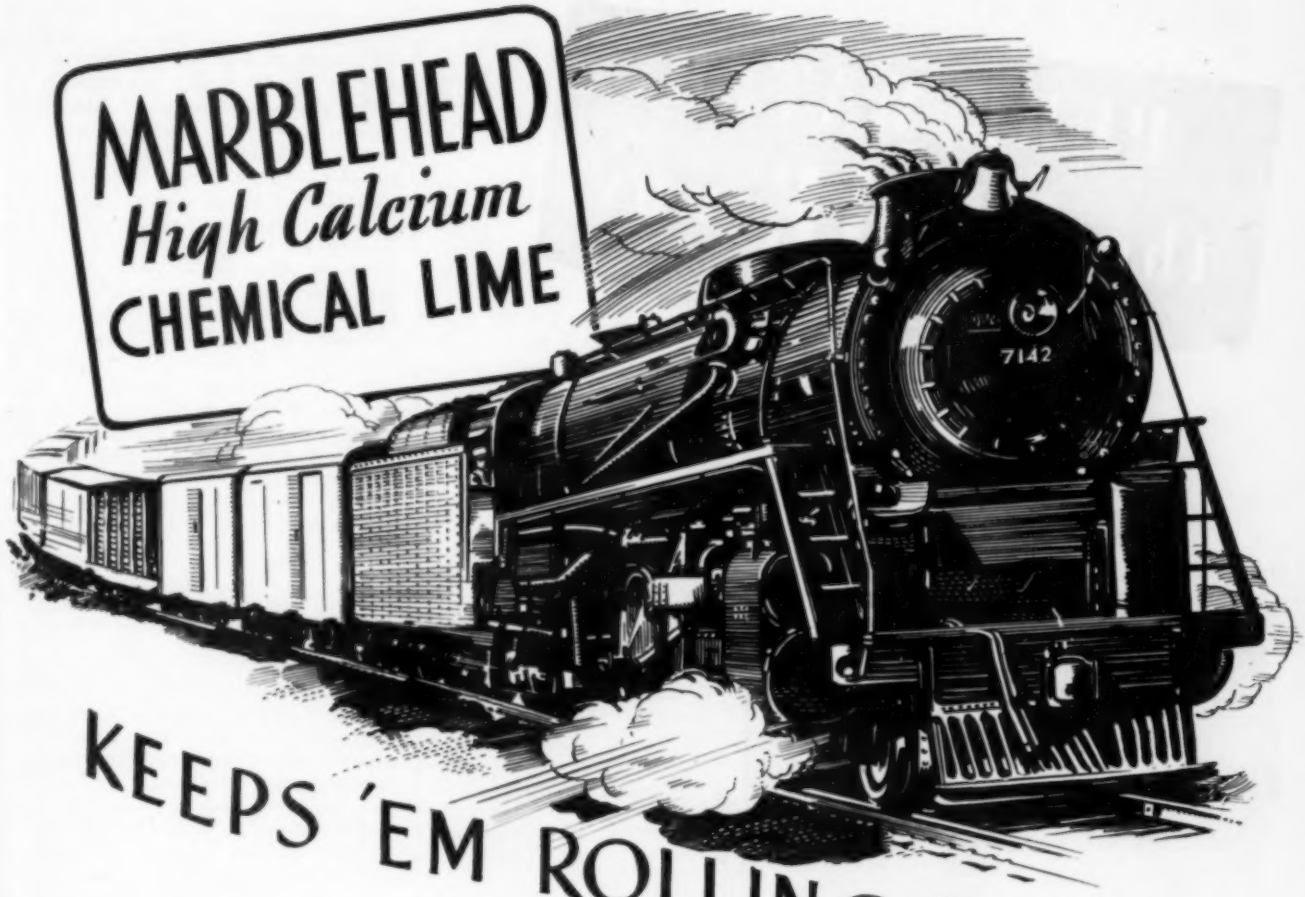

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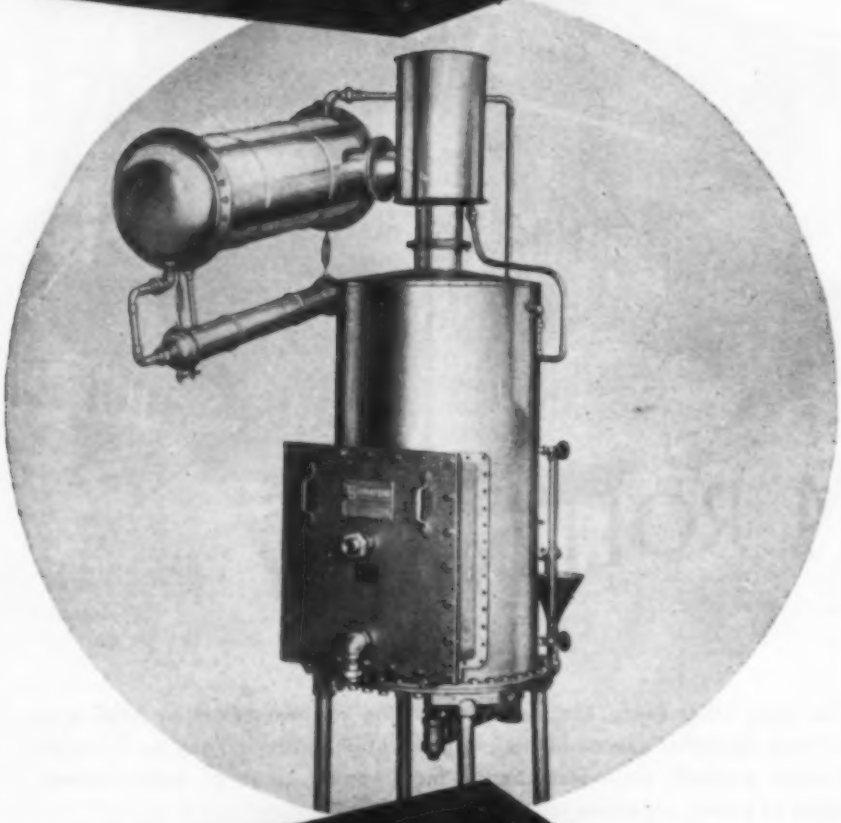

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as a condensation agent. The first phase of the condensation can be carried out with application of heat and at low pressure. Once the initial condensation has taken place, the solution of intermediate resin is mixed with the filler, dried at a low temperature and then ground. The necessary catalyst is then added for polymerization of the powder during pressing. Organic halogen derivatives are used as catalysts for such polymerization. Various fillers are added to the amino resin products, the one most frequently used in France being wood paste rich in alpha-cellulose. In the United States purified cotton waste is used to a considerable extent. Finely divided remnants of cloth can also be used. Stabilizing agents, pigments and dyes are also added to these powders. Use of amino-resin molding powders makes it possible to make products in the entire range of colors, from translucent tints to dark opaque or black shades.

Digest from "Amino Resin Molding Powders" by H. Gibello, *Plastiques* **2**, 36–45, 1944. (Published in France.)

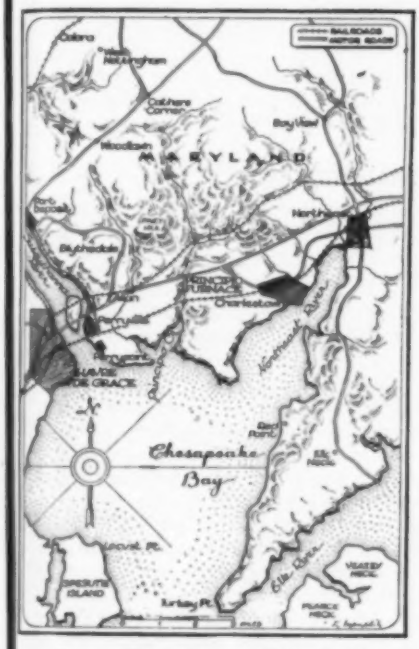
ANTIRUST PAINTS

ANTIRUST paint which is resistant to prolonged contact with sea water has to satisfy different conditions, depending on whether protection is required for fixed emerging parts (structures), semi-movable parts which are displaced at a slow speed (sluice gates), or parts in rapid motion (ships). Paints intended for ships must prevent development of animal colonies while those intended for structures must have maximum life. Up to the present, the protection afforded by a bituminous or tar coat on a foundation of red lead oil paint has not given satisfactory results in regard to life and antirust action. A series of experiments on submarine paints was conducted by Krousbein in Wilhelmshafen, in which plates were used which were 100x250x1 mm. and had been cleaned with a sand blast in order to get a slightly roughened surface. Different coats of a given antirust paint were applied to these plates with a brush at intervals of 48 or 72 hr. Some 8 days after application of the last coat the plates were placed in a bath so that one part remained continuously submerged in sea water and the other part was subjected alternately to the action of air and of sea water. The samples were studied carefully every three months and, at the end of 4 years, after the paint had been removed, they were studied from the point of view of corrosion. It was found that red lead oil paints usd as priming last a very short time in sea water. The majority of these paints change at the end of one or two years. Resin-oil paints covered with pitch or liquid tars in the cold were not satisfactory with sea water and lasted a short time. Bituminous pastes applied hot and used alone gave good results when the coats had sufficient toughness and elasticity at the same time. Chlorinated rubber, especially in the presence of bituminous products, produced films which resisted sea water very well for a long time.

Digest from "Behavior of Antirust Paints on Exposure to Sea Water," *Z. Ver. Deutsch. Ing.* **86**, 669, 1942. (Published in Germany.)

CHEMICAL ENGINEER'S BOOKSHELF

LESTER B. POPE, Assistant Editor



From "Principio to Wheeling"

OF PIGS AND SOWS

PRINCIPIO TO WHEELING. *By Earl Chapin May. Published by Harper and Bros., New York. 335 pages. Price $3.*

AUTHOR MAY has evidently been rummaging about in the local archives around Wheeling, W. Va., and has come forth with what amounts to a "biography" of the Wheeling Steel Corp. Picking up the thread at Principio Furnace in the Province of Maryland, we see first, John England, colonial ironmaster, stubbornly trying to eke out a few tons of pig iron from ore, charcoal, and oyster shells dumped a basketful at a time into his 30-ft. iron smelter.

From that great-granddaddy among blast furnaces, the story of iron and steel is told by a long procession of puddlers, ironmasters, forgers, nailers, heaters, rollers—most of them anonymous but each contributing his hard-handed bit to the industry which was eventually to give its name to the age we live in. Not all steelmakers have remained anonymous, however. There are a few whose names may have a familiar, and to some old-timers even a nostalgic, ring—names like Hubbard, Hearne, Glass, Carnegie, Schwab, Gates, Gary. Even the George Washington family had a hand in iron making in the early days. The long parade through the years doesn't come to rest until it finally reaches the present-day activities of Wheeling Steel.

From the standpoint of historical accuracy the book is to be commended for its documentation. But documentation, unfortunately, has a way of getting in the way of the narrative, and there will be times when the reader will wish that a little less attention had been given to minor characters around the fringes of the plot. One gets the impression that the author is giving the "names and numbers of all the players" simply because he worked hard to dig them out of dusty old records and he hasn't the heart to throw away such hard-won data. It is only fair to add, however, that he does not indulge himself very often.

"Principio to Wheeling" is not a textbook nor is it a reference work. It's a book to read through and enjoy during a quiet evening at home. And while the reader won't find that he can't lay it down at bed time, it should bring much pleasure and satisfaction to anyone associated with the steel industry, and particularly to those in Wheeling Steel and Wheeling the City—certainly the closing chapters sing loudly enough the praises of both.

POSTWAR PROSPERITY

PROSPERITY—WE CAN HAVE IT IF WE WANT IT. *By Murray Shields and Donald B. Woodward. Published by McGraw-Hill Book Co., New York. 190 pages. Price $2.*

Reviewed by Chaplin Tyler

MURRAY SHIELDS and Donald Woodward are respectively economist of the Irving Trust Co. and research assistant to the president of the Mutual Life Insurance Co. of New York. The authors dissect various economic cure-alls so fashionable in the prewar decade. They argue persuasively that neither prosperity nor full employment can be realized through public works, slum clearance, special favors to small business, foreign loans, deficit financing, redistribution of income, managed money, or repeal of antitrust laws.

The urge recognition that prosperity under the entrepreneur system depends fundamentally upon incentives that attract venture capital, increase labor's productivity, and induce mass consumption. They call for a halt to profligate spending and lending by Government of other people's money. They don't mention Bretton Woods by name, but they comment thus on handouts in general: "All we can accomplish by lending or giving away vast quantities of money and goods is to incur ill will and increase the domestic tax bill, both of which are utterly inconsistent with prosperity."

As the basis for postwar prosperity, the authors plead hard and long for rational fiscal policy. Some excerpts: "The time has come . . . for the Federal Government to limit its expenditures to activities which are obviously productive . . . " "With a debt of a quarter trillion the nation cannot afford the luxury of inefficiency in government administration." " . . . the administration itself should welcome an opportunity to have its position vindicated if it really is as efficient as is sometimes contended." "We need desperately a tax system under which capital (both individual and corporate) will come out of the storm cellar . . ."

In one respect the reviewer was disappointed: Documentation and specific examples could have been used with telling effect in many parts of the book, thus serving to button up the arguments presented. Most *Chem. & Met.* readers need no such proofs, but there are some who otherwise might suspect in the authors a propaganda motive.

ASPHALTIC SUBSTANCES

ASPHALTS AND ALLIED SUBSTANCES. *Fifth edition. By Herbert Abraham. Published by D. Van Nostrand Co., New York. 2,142 pages. Price $20.*

Reviewed by D. L. Katz

THE FIRST edition was published in 1918 and the fourth edition in 1938. The fifth edition represents no major changes or enlargements to the treatise but a revision to include recent publications, patents, and technological improvements. The book treats the occurrence, modes of production, uses in the arts, and methods of testing for asphalts and hundreds of allied substances. It provides a modern version for those having earlier editions and would be invaluable to anyone working with asphaltic substances who does not have access to this standard reference.

The term "allied substances" is interpreted very broadly and includes such materials as wood and coal tar, fatty acid

RECENT BOOKS RECEIVED

Analysis of Foods. By A. L. Winton & K. B. Winton. Wiley. $12.

Engineering Preview. By L. E. Grinter, H. N. Holmes, H. C. Spencer, R. Oldenburger, C. Harris, R. G. Kloeffler & V. M. Faires. Macmillan. $4.50.

How To Solve It. By B. G. Polya. Princeton. $2.50.

Industrial Organization and Management. By L. L. Bethel, F. S. Atwater, G. H. E. Smith & H. A. Stackman, Jr. McGraw-Hill. $4.50.

Industrial Plastics. 3rd ed. By H. R. Simonds. Pitman. $5.

The New Plastics. By H. R. Simonds, M. H. Bigelow & J. V. Sherman. Van Nostrand. $4.50.

The Measurement of Colour. By W. D. Wright. Adam Hilger, Ltd. 30s.

Plastics in Practice. By J. Sasso & M. A. Brown, Jr. McGraw-Hill. $4.

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pitch, and acid sludges from petroleum. Historical uses of asphalt, sources of the materials and processing operations in their manufacture are described. The end use including test methods for finished products completes the story. The bibliography of books, articles, and patents along with the indices cover the last 631 pages.

The reader is impressed by the complexity of colloidal and plastic substances and how little fundamental information is represented by the thousands of research papers abstracted by the author. The lack of a satisfying theory as to the ultimate nature of asphaltic substances is offset by innumerable empirical tests to distinguish products having desirable properties.

STRAIGHT LINES

ALIGNMENT CHARTS. *By Maurice Kraitchik. Published by D. Van Nostrand Co., New York. 94 pages. Price $2.50.*

Reviewed by Robert F. Benenati

THIS elementary text, consisting of 12 brief chapters, is another addition to the rapidly expanding literature on graphical calculators. The science of nomography is presented in this book in an abbreviated, but nevertheless logical manner. First a review of algebra, analytical geometry and determinants is presented with particular emphasis on their application to actual chart construction. All graphical charts may be classified either according to the type of algebraic functions involved or to the appearance or geometry of the finished chart, i.e., the number of lines, their shape, and relative positions with respect to one another. The author has chosen this latter course, and has proceeded from the very simple types to more complex ones. For each type of chart discussed, the author has chosen a representative formula and has followed it through to the finished chart.

In general it can be said that this book offers an interesting and varied review of one phase of a broad subject; however, charts involving one or more curved lines have been mentioned only in a general sense and some of the most interesting types involving a multiplicity of straight and curved lines have not been mentioned at all. The reader is hurried through the subject so rapidly that this book can not be recommended as more than just another book on nomograms.

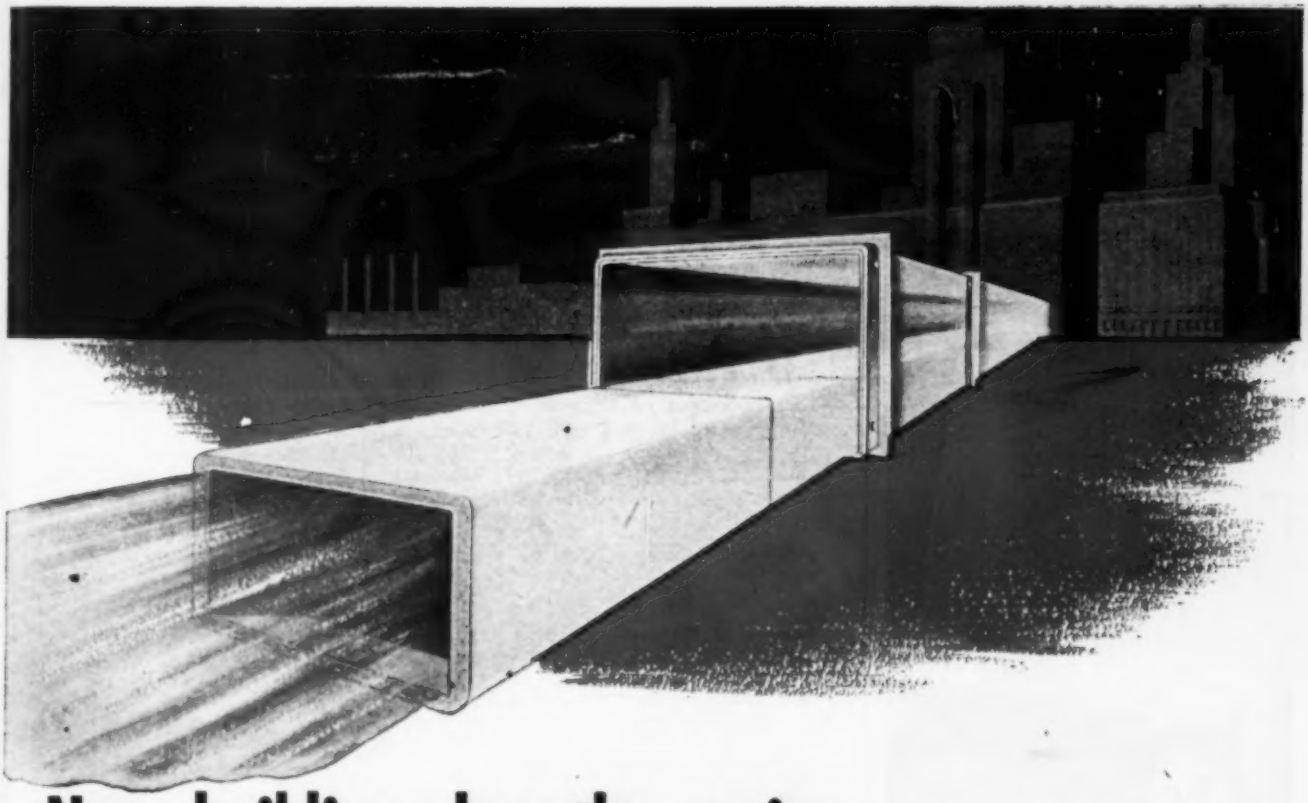
CHEMISTRY TEXTBOOK

INTRODUCTORY GENERAL CHEMISTRY. *Third edition. By Stuart R. Brinkley. Published by The Macmillan Co., New York. 645 pages. Price $4.*

Reviewed by F. C. Nachod

BRINKLEY'S well-established and time-honored text appears in its third edition, increased in volume and material, attractively printed and bound. The subject matter is well presented and the outline follows more or less the conventional pattern.

It speaks well for the author that he devotes considerable space to such topics as the Brönsted-Lowry concept of proton donors and acceptors, instead of by-passing the more recent developments, a fault



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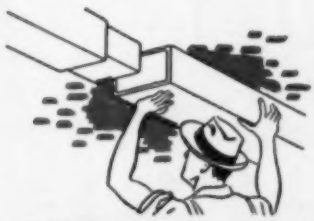

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often encountered even in recommended textbooks.

The last chapter (35) entitled Derivatives of the Hydrocarbons is destined to arouse the student's interest in the many subdivisions of organic chemistry, and a few pages are devoted to the fields of petroleum, cellulose, synthetic resins, explosives, dyes, drugs, foods, and hormones. While these short notes are only meant as stimulants, so to say as dessert for the good student who stuck by the general chemistry course to the very end, it would be helpful to reward him a little more generously, that is, giving more than the bare outlines, and if possible to augment these topics with pictures, plates, and diagrams.

The teacher will find an ample supply of exercises and problems, the student will be pleased by the numerous appendixes, and the well-selected lists of supplementary reading. All in all, here is a thorough and useful general chemistry textbook.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publication noted in this list always give the complete title and the issuing office. Remittance should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper covers unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the Bureau responsible for its issue.

Differential Thermal Analysis, Its Application to Clays and Other Aluminous Minerals. By Sidney Speil and others. Bureau of Mines. Technical Paper 664. Price 20 cents.

Analyses of Tennessee Coals. Bureau of Mines. Technical Paper 671. Price 35 cents.

Semi-Pilot-Plant Investigations of Nitrogen Dioxide Process for Beneficiation of Manganese Ores. By A. L. Fox and others. Bureau of Mines. Technical Paper 674. Price 10 cents.

Procedure for Testing Nonemergency Gas Respirators (Chemical Cartridge Respirators) for Permissibility. Bureau of Mines. Schedule 23. Price 5 cents.

The Hazard of Hydrogen Fluoride Poisoning in the Mineral and Allied Industries. By R. R. Sayers and Sara J. Davenport. Bureau of Mines. Information Circular I.C. 7311. Mimeographed.

Coke-Oven Accidents in the United States, Calendar Year 1943. By W. W. Adams and V. E. Wrenn. Bureau of Mines Technical Paper 675. Price 10 cents.

Diamond Drilling of Blast Holes Lake Superior District Iron-Ore Mines. By Ernest W. Johnson and Frank E. Cash. Bureau of Mines. Information Circular I.C. 7317. Mimeographed.

Geophysical Survey of Arkansas Bauxite Region. By J. R. Thoenen, M. C. Malamphy, and J. L. Vallely. Bureau of Mines. Report of Investigations R.I. 3791. Mimeographed.

Inflammability of Natural Gas: Effect of Pressure upon the Limits. By G. W. Jones and R. E. Kennedy. Bureau of Mines. Report of Investigations R.I. 3798. Mimeographed.

Beneficiation of Iron Ores by Flotation. Part 1. Anionic Flotation of Silica from Cal-

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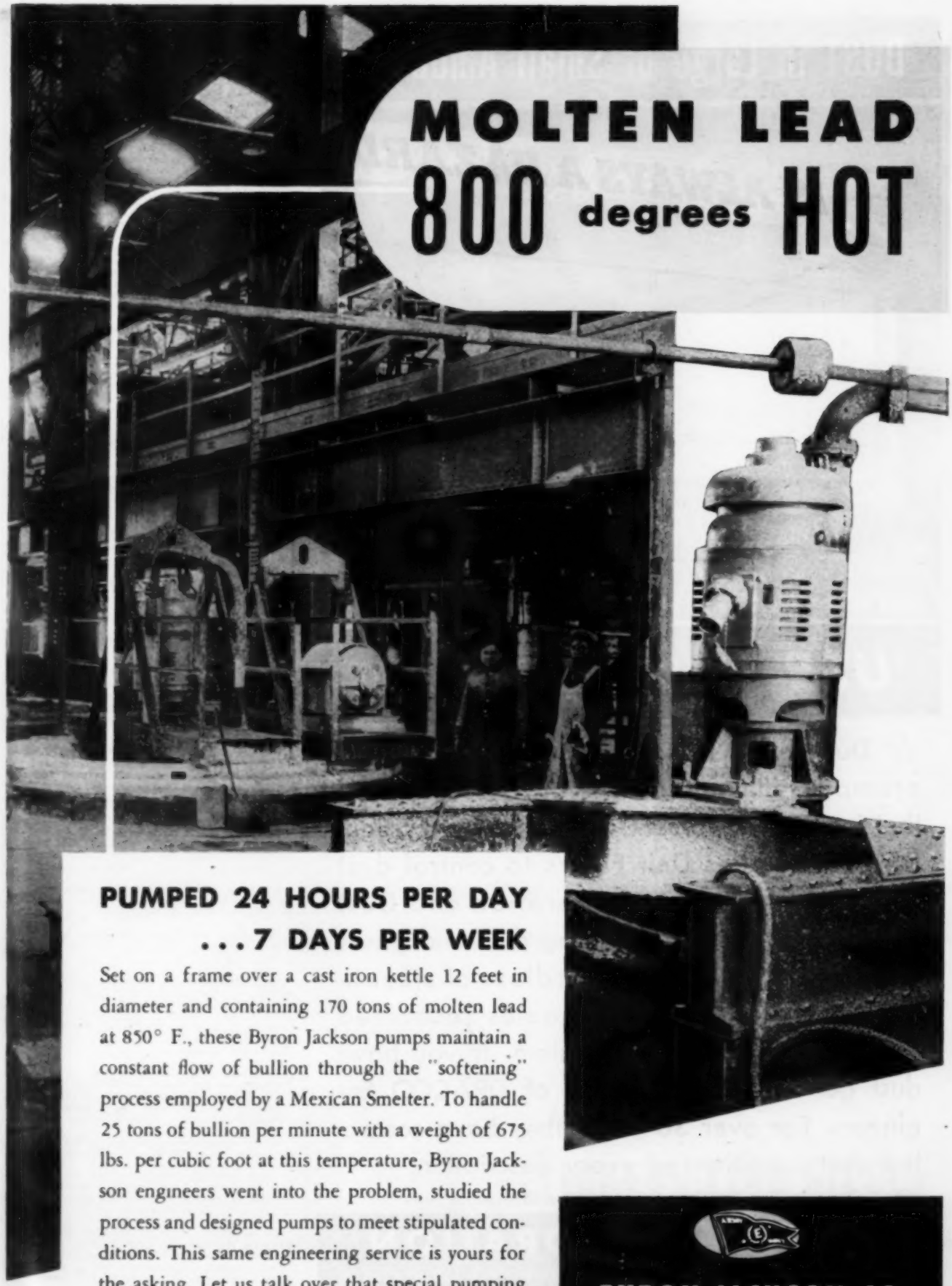

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careous Red Iron Ores of the Birmingham District, Alabama. By J. Bruce Clemmer and others. Bureau of Mines. Report of Investigations R.I. 3799. Mimeographed.

Summary of Bureau of Mines Exploration Projects on Deposits of Raw Material Resources for Steel Production. By C. E. Julihn and Lowell B. Moon. Bureau of Mines. Report of Investigations R.I. 3801. Mimeographed.

Survey of the Suitability of Domestic Talcs for High-Frequency Insulators. By Theron A. Klinefelter, Sidney Speil, and Signey Gottlieb. Bureau of Mines. Report of Investigations R.I. 3804. Mimeographed.

Minerals Yearbook 1942. Bureau of Mines. Price $2.25. Clothbound. Now released from military secrecy. Yearbook for 1943 will be released in July.

Check List for the Introduction of New Consumer Products. Bureau of Foreign and Domestic Commerce. Economic Series No. 41. Price 10 cents.

Code for Protection Against Lightning. Bureau of Standards. Handbook H40. Price 20 cents.

Iron and Steel Relief Valves for Petroleum, Chemical, and General Industrial Services. Bureau of Standards. Simplified Practice Recommendation R205-44. Price 5 cents.

Abrasive Grain Sizes. Bureau of Standards. Simplified Practice Recommendation R118-45. Price 5 cents.

Latin American Periodicals Currently Received in the Library of Congress and in the Library of the Department of Agriculture. The Library of Congress 1944. Price 45 cents.

Bibliography of Industrial Hygiene 1900-1943. Public Health Service. Bulletin No. 289. Price 20 cents.

Cotton Production and Distribution, Season of 1943-1944. Bureau of the Census Bulletin 181. Price 15 cents.

Establishing and Operating a Metal Working Shop. Bureau of Foreign and Domestic Commerce. Price 35 cents.

Statistics of Income for 1941. Part 2. Compiled from corporation income and declared value excess-profits tax returns, corporation excess profits tax returns and personal holding company returns. 1945. Internal Revenue Bureau. Price 45 cents.

Statistics of Income for 1942. Part 2. Preliminary report of corporation income and declared value excess-profits tax returns and corporation excess profits tax returns, filed through Dec. 31, 1943. Internal Revenue Bureau. Price 10 cents.

Results of Tests Made with DDT Against the Japanese Beetle in 1944. By C. H. Hadley and W. E. Fleming. Bureau of Entomology and Plant Quarantine. E-645. Mimeographed.

Effect of War-Contract Cut-Backs on Selected Plants. Bureau of Labor Statistics. Bulletin No. 818. Price 5 cents.

Wages in the Rayon Industry May 1944. Bureau of Labor Statistics. Bulletin No. 806. Price 10 cents.

Reconversion Problems in the Buffalo Industrial Area. Bureau of Labor Statistics. Bulletin No. 804. Price 10 cents.

Work Injuries in the United States During 1943. Bureau of Labor Statistics. Bulletin No. 802. Price 10 cents.

Reserves, Bed Characteristics, and Coking Properties of the Willow Creek Coal Bed, Kemmerer District, Lincoln County, Wyoming. By Albert L. Toenges and others. Bureau of Mines Technical Paper 673. Price 25 cents.

Accident Statistics as an Aid to Prevention of Accidents in Metal Mines. Metal-Mine Accident-Prevention Course. Section 1. This section 1 deals with accident prevention training and includes material of interest to process industry as well as mining. Bureau of Mines, Miners' Circular 51. Price 10 cents.

Evaporation Losses of Aviation Gasoline in Standing Storage. By Peter Grandone. Bureau of Mines Report of Investigations R.I. 3701. Mimeographed. Distribution was restricted for about eighteen months after original issue.

Study of Firing Failure in Massive Talc. By Howard F. Carl. Bureau of Mines Report of Investigations R.I. 3800. Mimeographed.

Surface Storage of Explosives. By D. Harrington and R. G. Warncke. Bureau of Mines

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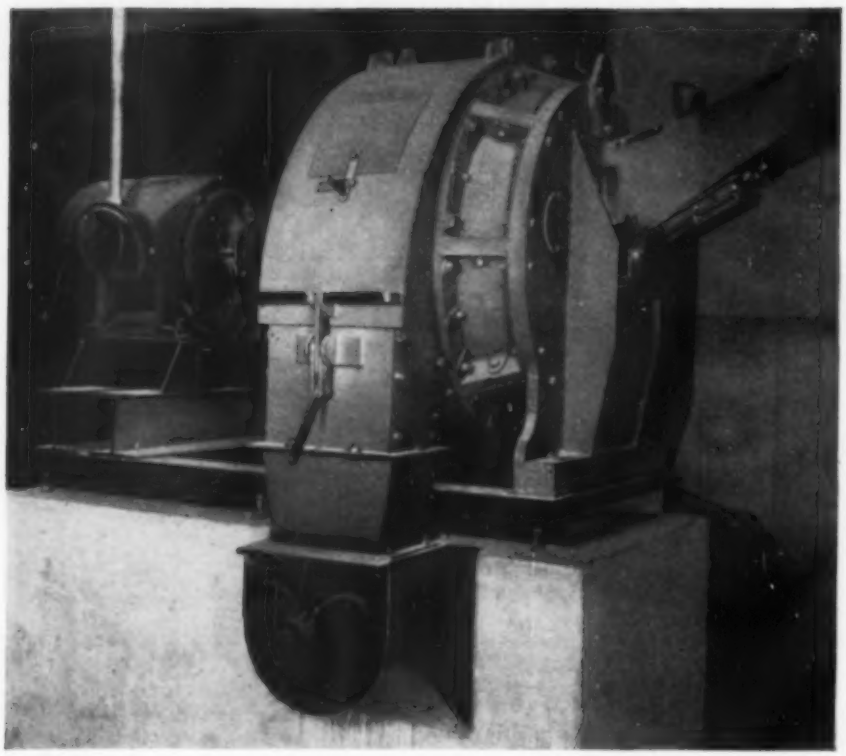

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RECENT BOOKS & PAMPHLETS

Wartime Wage Control and Dispute Settlement. Published by The Bureau of National Affairs, Washington, D. C. 576 pages. Regulations relating to wage-salary stabilization.

The Forest Industries Blaze New Trails. Published by Timber Engineering Co., 1319 18th St., N.W., Washington, D. C. 32 pages. Current technological developments of wood as an engineering medium.

Review of Iron and Steel Literature for 1944. By E. H. McClelland. Published by Carnegie Library of Pittsburgh. 25 pages. A classified list.

Manual on Assembly Gluing. Published by The Society of the Plastics Industry, 295 Madison Ave., New York 17, N. Y. 24 pages. Price $1. Latest developments in the resin gluing of parts and subassemblies.

Conservation of Fuel for War. By Oliver Bowles. Available from Industrial Mineral Wool Institute, 441 Lexington Ave., New York 17, N. Y. 21 pages. Industrial insulation with mineral products.

Aqueous Hydrofluoric Acid. Recommended Practice for the Safe Handling and Discharging of Containers. Manual Sheet H-1 published by Manufacturing Chemists' Association, 608 Woodward Building, Washington 5, D. C. 6 pages. Price 15 cents. Revised edition with added directions for treatment of acid burns.

Patent Digest Service; Resins, Rubbers, Plastics. Edited by H. Mark. Published by Interscience Publishers, 215 Fourth Ave., New York 3, N. Y. Price $45 per year. A loose-leaf abstract service with 12 issues per year.

Research, Invention, and Patents. By A. A. Potter. Available from Industrial Research Institute, 60 East 42nd St., New York 17, N. Y. 8 pages. An address by the dean of engineering of Purdue University and executive director, National Patent Planning Commission.

Steel Pipe Progress. Available from American Iron and Steel Institute, 350 Fifth Ave., New York 1, N. Y. 12 pages. Describes the scope of the program of the Committee on Steel Pipe Research.

Veteran's Guide. By Dallas Johnson. Pamphlet No. 102 published by Public Affairs Committee, 30 Rockefeller Plaza, New York 20, N. Y. 32 pages. Price 10 cents. To help returning service men, whether able-bodied or handicapped.

Cartels or Free Enterprise? By Thurman W. Arnold. Pamphlet No. 103 published by Public Affairs Committee, 30 Rockefeller Plaza, New York 20, N. Y. 31 pages. Price 10 cents. Restoration of free enterprise in America after the war rests on the elimination of cartels and other restrictive devices—the author says.

Health Care for Americans. By C. E. A. Winslow. Pamphlet No. 104 published by Public Affairs Committee, 30 Rockefeller Plaza, New York 20, N. Y. 31 pages. Price 10 cents. The people of the United States can obtain good medical care only through a unified national health program.

A.S.T.M. Standards on Paper and Paper Products. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 182 pages. Price $1.50. Second edition with 49 specifications, test methods and related standards.

A.S.T.M. Specifications for Steel Piping Materials. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 337 pages. Price $2. Compilation of widely-used standards with many Emergency Alternate Provisions.

The Effect of Molecular Structure of Fuels on the Power and Efficiency of Internal Combustion Engines. By Charles F. Kettering, vice president, General Motors Corp., Detroit, Mich. 12 pages. An address before the American Chemical Society, New York, Sept. 13, 1944.

Industrial First Aid in Chemical Injuries of the Eye. By J. M. Carlisle, M.D. Publication 419 of the National Society for the Prevention of Blindness, 1790 Broadway, New York 19,

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Development of a Terpene Thiocyano Ester (Thanite) as a Fly Spray Concentrate. By R. L. Pierpont. Bulletin 253 published by the University of Delaware, Newark, Del. 58 pages. Results of a study which proved Thanite to be an effective insecticide which can be safely and economically used in commercial household and cattle fly spray formulas.

The World System of Decimal Weights, Measures, Graduation, and Time. By Hamar. Published by Universal Unit Systems, 60 East 42nd St., New York 17, N. Y. Details and advantages of a proposed new system.

Strength Properties of Yellow Poplar From Virginia. By E. G. Stren. Engineering Experiment Station Series No. 59, published by Virginia Polytechnic Institute, Blacksburg, Va. 36 pages. Price 25 cents. Test data on strength properties. Also included is a short description of the VPI Wood Research Laboratory by Dean Norris.

Classification of Copper and Copper Alloys. Published by Copper Development Association, Grand Buildings, Trafalgar Square, London, W.C.2. Tabular data concerning composition, mechanical properties, and principal uses of copper and the more important copper-base materials.

Production Management—And How It Affects Productivity, Costs and Employment. Published by Albert Ramond and Associates, 6300 Chrysler Building, New York 17, N. Y. 38 pages. Policies and procedures for solution of problems created by wartime expansion of our productive capacity and working force.

RECENT PUBLICATIONS ON WESTERN RESOURCES

Postwar Development Possibilities in Clallam County, Olympic Peninsula, Washington. By Dr. H. K. Benson, Professor of Chemistry, University of Washington, Seattle, Wash. 16 pages. Postwar possibilities in this county of insulation board manufacture from logging waste, fisheries products, manganese treating plants, hemlock tannin extraction, alcohol from pulp mill waste liquors, and other similar industries.

Industrial Non-Metallic Minerals. By G. A. Joslin, Chairman, Mining Committee, Los Angeles Chamber of Commerce, Los Angeles, Calif. 42 pages. Commercial non-metallic minerals of California and the West with summarized information on domestic production, western deposits, foreign sources, consumption trends, industrial uses, marketing, prices, California producers, and lists of possible buyers. Also contains a list of industrial mineral milling plants and chemical manufacturers in the Los Angeles area.

Starch, Sirup and Dextrose Sugar from Washington Wheat and Potatoes. By John A. Guthrie and Joseph L. McCarthy. Research Project 465, published by the Washington State Planning Council, Olympia, Wash. 45 pages. Report on the postwar prospects for industrial development of a wheat and potato wet-milling industry in the state. Discusses raw materials, technology, economics and markets for the products and byproducts of the wet-milling industry.

Metropolitan Oakland Area. Published by Metropolitan Oakland Area, 300 Chamber of Commerce Bldg., Oakland 12, Calif. 44 pages. Present industrial facilities, markets, income, distribution system, water and power facilities, etc. of the area.

Hub of Western Industry. Published by Sacramento Chamber of Commerce, 917-7th St., Sacramento, Calif. 30 pages. Maps showing the power and natural gas supply, raw materials, agriculture, rail and air lines, highways and water transportation of central California. Also contains statistics on population, agriculture, mineral resources and lumber production.

Arizona Mines, Sales Opportunities. Domestic Trade Dept., Los Angeles Chamber of Commerce, Los Angeles, Calif. 42 pages. Survey of the mining activities in Arizona with mines arranged by counties. Gives name and location of each mine, operators or owners, superintendent and other officials, type of ore

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mined, number of employees, transportation facilities, and other similar information.

Nevada Mines, Sales Opportunities. Domestic Trade Dept., Los Angeles Chamber of Commerce, Los Angeles, Calif. 26 pages. Surveying the mining activities of Nevada and giving the same type of information as outlined under "Arizona Mines."

Southern California Mines, Sales Opportunities. Domestic Trade Dept., Los Angeles Chamber of Commerce, Los Angeles, Calif. 30 pages. Mimeographed booklet surveying the mining activities of Southern California and giving the same type of information as outlined under "Arizona Mines."

Investigations With DDT in California, 1944. Prepared under the direction of The Division of Entomology and Parasitology, Agriculture Experiment Station, University of California, Berkeley 4, Calif. 33 pages. Preliminary report giving details of test conditions and results with DDT on certain cotton insects, grape leafhopper, onion thrips and other insects, particularly those of greatest threat to California agricultural crops.

Shasta County Raw Materials. Redding Chamber of Commerce, Redding, Calif. Map showing the location and extent of mineral, forest and agricultural raw materials of Shasta County, Calif., as well as hydroelectric power and water facilities.

Pacific Northwest Industry. Bureau of Business Research, University of Washington, Seattle 5, Wash. Yearly subscription $2. Monthly publication devoted to current surveys of industry and business in the Pacific Northwest. Contains articles describing new and typical established industries of the region as well as news items, bibliographies, and industrial notes.

Industrial Utah. Chamber of Commerce, Salt Lake City, Utah. 14 pages. Present mineral resources, manufacturing facilities and agriculture of the state. Contains maps showing location of phosphate, potash and coal deposits of the western states.

Plastics Industry of Los Angeles County. Industrial Dept., Los Angeles Chamber of Commerce, Los Angeles, Calif. 10 pages. Plastics raw material facilities and market potentials for the area. Includes a listing of raw material manufacturers and a directory of plastic molders and processors by type of process used.

Selected List of Publications. Western Regional Research Laboratory, U. S. Dept. of Agriculture, Albany, Calif. A mimeographed listing of publications by the personnel of the Laboratory dealing principally with byproduct utilization, processing of foods, enzyme research and pharmacology. Indicates which articles are available upon request in reprint form.

Recovery of Tartrates from Grape Wastes. Western Regional Research Laboratory, U. S. Dept. of Agriculture, Albany, Calif. 10 pages. Work conducted by the Laboratory on the industrial recovery of tartrates from brandy still slops and grape pomace. Includes flowsheets of the suggested processes.

Postwar California. California State Reconstruction and Reemployment Commission, Sacramento 14, Calif. A series of six pamphlets dealing primarily with the problems of postwar population and employment in California and specific areas of the state. Gives estimates on postwar population, jobs, income, industrial activity and spending. Specific areas dealt with include the San Francisco Bay area, Richmond and San Bernardino County.

Bibliography of the Geology and Mineral Resources of Utah. By Bronson F. Stringham. University of Utah, Salt Lake City, Utah. 99 pages. Price $1. A bibliography and complete index of the mineral resources and geology of the state brought up to December 31, 1942.

Geology of Nevada Ore Deposits and Mining Districts of Nevada. By Bernard York and Henry G. Ferguson. Published by the Nevada State Bureau of Mines and the Mackay School of Mines, Reno, Nev. 110 pages. Price 50 cents. Discusses the formation, origin and geology of the ore deposit regions as well as economic considerations of ores now being mined.

The Wine Industry. Published by the Wine Advisory Board, Wine Institute, 85 Second St., San Francisco, Calif. A series of four printed and illustrated pamphlets discussing the wine industry, its economic importance, statistics, wine terms, quality, uses and markets, and types of wines.

Light Metals Research. Published by Light Metals Advisory Committee, State College of Washington, Pullman, Wash. 20 pages. Broad discussion of the light metals research program and facilities of the institution.

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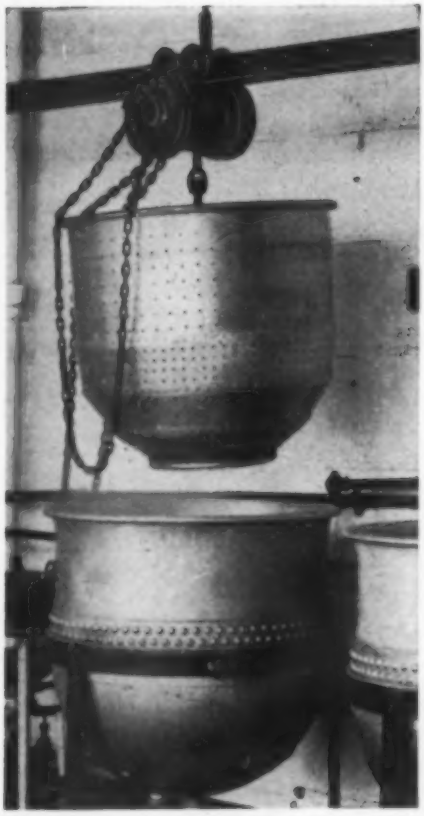

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterheads.

Acidproof Cement. Quigley Co., Inc., 527 Fifth Ave., New York 17, N. Y.—Bulletin AP 122. 8-page booklet illustrating and describing acidproof cement for bonding and repairing acid-resisting masonry structures. A list of products made by this company together with their applications are included.

Adhesives. Cordo Chemical Corp., 34 Smith St., Norwalk, Conn.—8-page booklet describing Cordo-Bond adhesives for metals, plastics, wood, glass, paper, cloth, leather and other materials.

Alloys. American Manganese Bronze Co., Philadelphia, Pa.—48-page reference book on bronze casting alloys contains general information regarding composition, characteristics and applications of many common and typical alloys.

Arc Converters. Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.—Bulletin B 6373. 8-page booklet illustrating mercury arc converters designed for induction heating operations in the 500-2,000 cycle frequency range. Details of construction, installation and operation are given.

Chain. The Youngstown Welding & Engineering Co., Youngstown 9, Ohio—4-page leaflet describing corrosion-resistant chain built by this company. The various advantages of corrosion-resistant chain materials together with engineering data are given.

Chain Belt. Chain Belt Co., Milwaukee 4, Wis.—Bulletin 461. 4-page illustrated leaflet describing the Rex table top chain belt built by this company. Construction details together with application data are included. Bulletin 460. 4-page leaflet giving information and application data on Rex Z-metal chain belt.

Chemicals. Los Angeles Chemical Co., 1960 Santa Fe Ave., Los Angeles 21, Calif.—56-page booklet describing the use and manufacture of the complete list of this company's products.

Chemical Feed Systems. Milton-Roy Pumps, 1300 E. Mermaid Ave., Chestnut Hill, Philadelphia 8, Pa.—Bulletin 451. 4-page leaflet describing chemical feed systems for boiler water treatment. Complete packaged units for single or multiple boiler installation are available.

Cleaning Compound. Hercules Powder Co., Wilmington, Del.—Technical booklet covering use of "Dresinates" in alkaline cleaning compounds. Properties of this material together with suggested applications are given.

Cleaning Compound. Klem Chemical Works, Detroit, Mich.—8-page folder describing Klem Kleaners for cleaning, derusting, phosphotizing, soldering and maintenance processes.

Columbium Metal. Fansteel Metallurgical Corp., North Chicago, Ill.—12-page booklet giving the properties and uses of columbium metal. Available forms of columbium metal are given together with columbium compounds. Tables of data on corrosion, oxidation, and effects of hydrogen on columbium are given. Form S-414.

Cooling Equipment. The Fluor Corporation, Ltd., 2500 South Atlantic Blvd., Los Angeles 22, Calif.—4-page pamphlet describing the Fin Fan cooling unit for the air cooling of liquids and vapors. Installation and application data are included.

Compressors. Clark Bros. Co., Inc., Olean, N. Y.—2-page leaflet featuring high pressure compressors.

Conveying Equipment. The Jeffrey Manufacturing Co., Columbus 16, Ohio—60-page booklet featuring coal and ashes handling machinery for power plants and boiler houses. Specifications, construction details with installation and application data are given.

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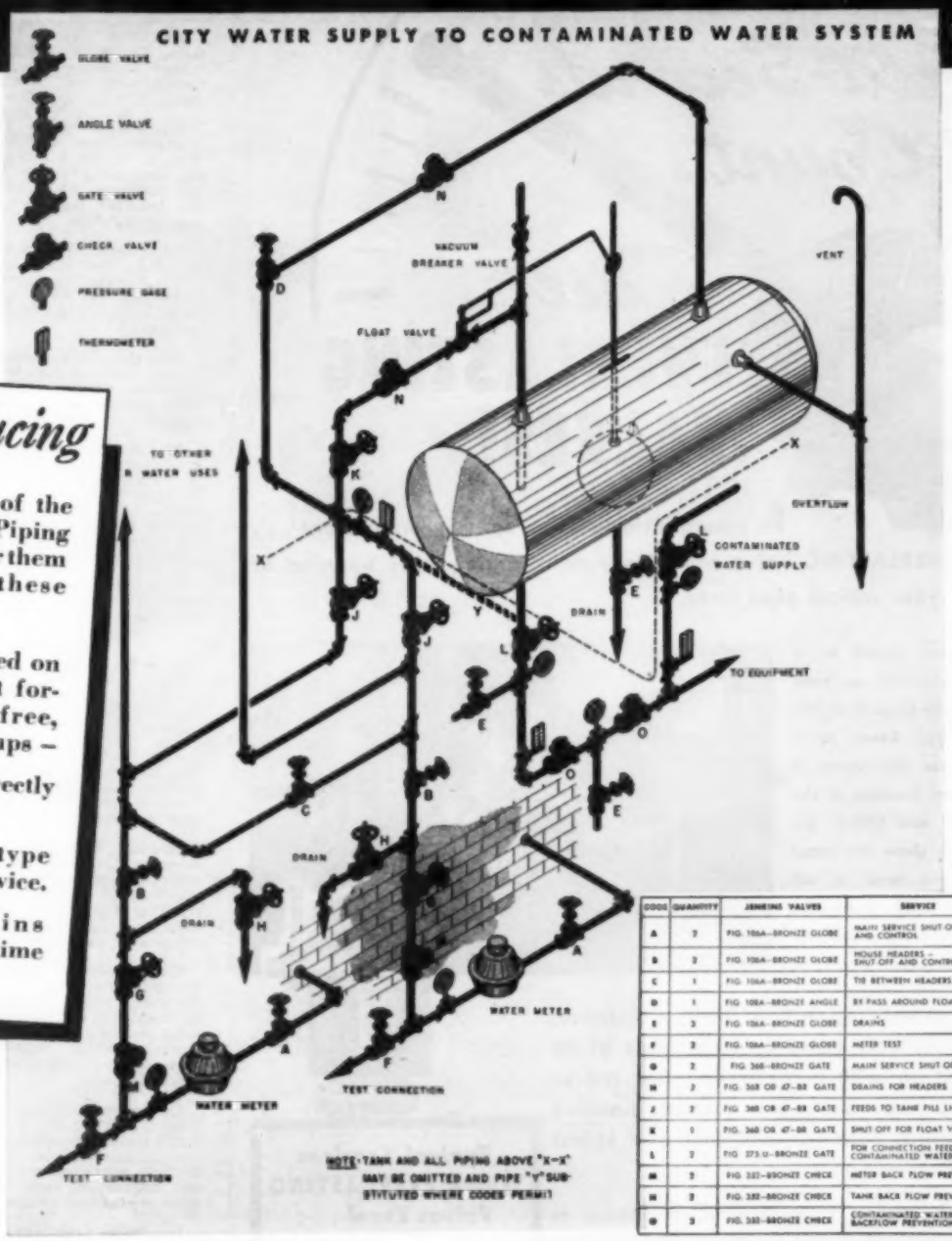

CODE	QUANTITY	JENKINS VALVES	SERVICE
A	2	FIG. 106A—BRONZE GLOBE	MAIN SERVICE SHUT-OFF AND CONTROL
B	2	FIG. 106A—BRONZE GLOBE	HOUSE HEADERS—SHUT-OFF AND CONTROL
C	1	FIG. 106A—BRONZE GLOBE	TIE BETWEEN HEADERS
D	1	FIG. 106A—BRONZE ANGLE	BY-PASS AROUND FLOAT VALVE
E	3	FIG. 106A—BRONZE GLOBE	DRAINS
F	2	FIG. 106A—BRONZE GLOBE	METER TEST
G	2	FIG. 368—BRONZE GATE	MAIN SERVICE SHUT-OFF
H	2	FIG. 368 OR 47–88 GATE	DRAINS FOR HEADERS
J	2	FIG. 368 OR 47–88 GATE	FEEDS TO TANK PILE LINE
K	1	FIG. 368 OR 47–88 GATE	SHUT-OFF FOR FLOAT VALVE
L	2	FIG. 375-U—BRONZE GATE	FOR CONNECTION FEEDING CONTAMINATED WATER SUPPLY
M	2	FIG. 532—BRONZE CHECK	METER BACK FLOW PREVENTION
N	2	FIG. 532—BRONZE CHECK	TANK BACK FLOW PREVENTION
O	3	FIG. 532—BRONZE CHECK	CONTAMINATED WATER SUPPLY BACKFLOW PREVENTION

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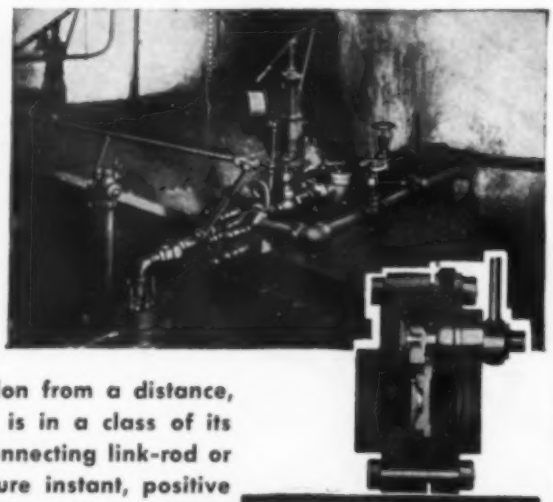

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Electronic Heating. Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.—Bulletin B 6372. 4-page leaflet describing this company's electronic heaters for induction and dielectric heating.

Equipment. First Machinery Corporation, East 9th Street and East River Drive, New York 9, N. Y.—Catalog No. 45. 96-page catalog illustrating process equipment handled by this company. Flow sheets and application data are included together with several pages of engineering data.

Equipment. Stacey Bros. Gas Construction Co., 5535 Vine St., Cincinnati 6, Ohio—Bulletin G-45. 44-page illustrated booklet describing the fabrication and erection of gas holders, storage tanks, processing vessels and other similar equipment.

Fiberglas. Owens-Corning Fiberglas Corp., Toledo, Ohio—8-page booklet describing various Fiberglas products. Booklet contains worthwhile data giving forms and sizes, major properties, and principal uses of this material.

Flexible Metal Hose. Packless Metal Products Corp., 31 Winthrop Ave., New Rochelle, N. Y.—71-page illustrated catalog featuring Packless Seamless Flexible Metal Hose and the various accessories equipment, such as couplings, flexible fasteners, etc. Engineering data including methods of selection, applications, and installation information are given.

Forgings. Titusville Forge Division, Struthers-Wells Corp., Titusville, Pa.—8-page illustrated bulletin describing this company's facilities for precision forging of industrial equipment.

Fuel Handling. Flotrol Systems, Inc., 385 Gerard Ave., New York 61, N. Y.—Bulletin FL 100-45. 8-page booklet describing this company's hydraulic and pumping systems for delivering liquid fuels.

Gear Pumps. George D. Roper Corp., Rockford, Ill.—8-page pamphlet featuring the rotary gear pumps used in various process industries. Contains performance data, dimensions, construction features and principles of operation.

Grinding Mill Liners. Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.—Bulletin B 6355. 4-page booklet featuring the uses and applications of the A-C Lorain liner. Economies resulting from using this separate lifter and liner plate construction instead of the integral one-piece construction are illustrated.

Heat Transfer Equipment. The Whitlock Manufacturing Co., 48 South St., Elmwood, Hartford 1, Conn.—Bulletin 645. 16-page booklet illustrates and describes heat transfer equipment including the shell and tube and coil types. Contains design, construction and application data together with a number of valuable engineering tables.

Incinerators. Morse Boulger Destructor Co., New York 17, N. Y.—Bulletin 160. 8-page leaflet featuring residential, municipal and industrial incinerators for the destruction of combustible waste materials. Design construction and application data, together with specifications of standard models are given.

Industrial Coatings. Carbozite Corp., First National Bank Bldg., Pittsburgh 22, Pa.—16-page booklet describing the properties and application of industrial coatings made by this company.

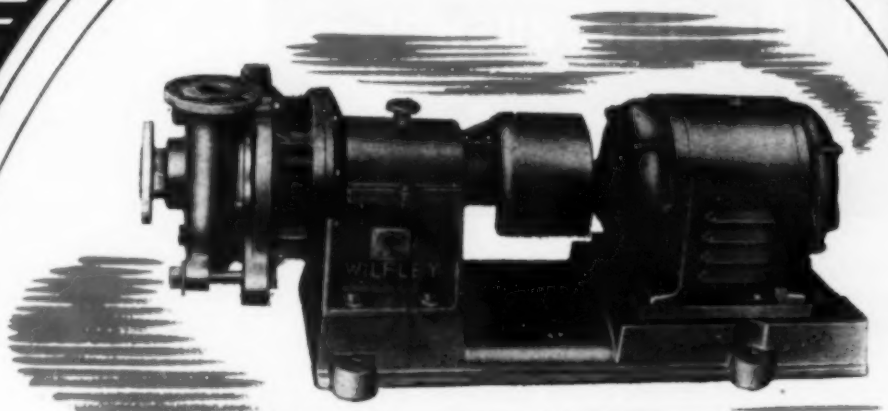
Instruments. Wheelco Instrument Co., Harrison & Peoria Sts., Chicago, Ill.—Bulletin C-6300. 12-page catalog describing principal items of equipment supplied by this company. Ordering data and prices are given.

Insulating Brick. Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh 22, Pa.—14-page booklet describing the use of insulating fire brick and insulating mortar. A table of heat losses and heat storage capacities for various high temperatures are given.

Lacquers. Hercules Powder Co., Wilmington, Del.—8-page leaflet describing the development of high solid lacquers made by this company.

Mechanical Rubber Goods. Miller Products Co., Inc., 29 Warren St., New York, N. Y.—34-page catalog of rubber, neoprene and other synthetic rubber goods, including illustrations and prices of many of the items handled by this company.

Mixtures. The Turbo Mixer Corp., 247 Park Ave., New York 17, N. Y.—Bulletin No. 11. 4-page booklet describing Turbo Mixers for a



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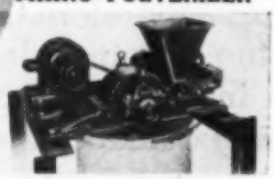

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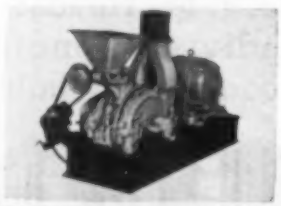

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Pipe Conduit. H. W. Porter & Co., Inc., Newark, N. J.—Bulletin 451. 4-page pamphlet describing Therm-O-Tile, a waterproof, insulating conduit for underground pipe lines.

Pressure Pumps. Warren Steam Pump Co., Inc., Warren, Mass.—Bulletin 238. 4-page illustrated booklet describing Warren hydraulic pressure pumps. Specifications and operating data are included.

Process Equipment. Haveg Corp., Newark, Del.—Bulletin F-4. 36-page illustrated booklet describing chemical and corrosion resistant process equipment. Completely indexed, this bulletin gives design and installation data together with tables and specifications, sizes, and other important chemical engineering information.

Protective Coatings. The B. F. Goodrich Co., Akron, Ohio—6-page leaflet describing Koroseal tape RX and Korolac RX, easy to apply protective coatings for plating racks and other masking work. Advantages of these materials in resisting acids and alkalis in plating racks are described and methods of application given.

Protective Coatings. Reilly Tar & Chemical Corp., Indianapolis 4, Ind.—20-page booklet describing typical applications of coatings made by this company for metal, brick, cement, and wood surfaces.

Pumps. Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.—Bulletin B6351. 4-page leaflet featuring this company's type FF-B pedestal centrifugal pump. Standard specifications with a table of principal dimensions are included.

Pumps. Goulds Pumps, Inc., Seneca Falls, N. Y.—35-page booklet featuring the wartime uses of Goulds Pumps. Emphasizes the various uses of pumps in the many types of seagoing warcraft.

Rubber Engine Mounting. Bushings, Inc., 3442 West Eleven Mile Road, Berkeley, Mich.—2-page bulletin featuring insulated rubber engine mounting for stopping engine vibration. A simplified formula for calculating the proper mounting for any given load as well as dimension drawings of typical mountings are included. Bulletin BU-23.

Rust Prevention. The Johnson & Jennings Co., Cleveland 14, Ohio—Bulletin R-181. 12-page booklet describing the Cathodic (electrical) method of preventing the rusting of steel tanks, piping and other steel structures. Principles of this method of rust-prevention, together with application data are included.

Sorbose. Schwartz Laboratories, Inc., 202 East 44th St., New York 17, N. Y.—Bulletin 108. 4-page leaflet giving composition, derivatives, properties, and uses of l-Sorbose.

Synthetic Phenol. John M. Weiss Co., Chemical Engineers, 15 East 41st St., New York 17, N. Y.—8-page illustrated reprint discussing synthetic phenol production in Alabama. A flow sheet together with pictures of equipment are shown.

Synthetic Sheet Rubber. E. I. du Pont de Nemours & Co., Wilmington, Del.—10-page technical service manual describing Du Pont's "Fairprene" synthetic rubber sheet stock.

Transportation Equipment. Automatic Transportation Co., 101 W. 87th St., Chicago, Ill.—6-page folder describing electric industrial trucks built by this company.

Tubing. The Babcock & Wilcox Tube Co., 85 Liberty St., New York 6, N. Y.—Technical data card 123. 4-page leaflet listing many applications of both the seamless and welded tubes made by this company.

Tubing. The Youngstown Welding & Engineering Co., Youngstown 9, Ohio—8-page booklet describing Weldco tubing, piping and fittings for use by the process industries.

Unit Heaters. D. J. Murray Manufacturing Co., Wausau, Wis.—12-page booklet describing cast-iron fin-type unit heaters and their installation. Contains information on corrosion and its influence on unit heaters.

Valves. American Car & Foundry Co., 30 Church St., New York 8, N. Y.—Bulletin S 5M-4-45. Illustrated leaflet describing the use of ACF lubricated plug valves in sewage disposal plants.

Water Hose. B. F. Goodrich Co., Akron, Ohio—Catalog section X 4800. 2-page leaflet describing water hose made by this company.

CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

PRODUCTION OF CHEMICALS ON DOWNWARD TREND WITH INDUSTRIAL DEMAND HOLDING STEADY

DOWNWARD revisions in some parts of the military program have been followed by a drop in total production of chemicals and, as further cuts are expected to follow, the production trend promises to follow a steadily falling curve. The latest indexes available are those of the Federal Reserve Board which show a drop of two points from March through April for both the chemical and industrial chemical groupings. Developments on the war front since April no doubt will bring still lower index numbers for May and from then on the declines should be more pronounced.

While the greater part of cutback to date has centered in what is covered by the broad term of munitions, some of the regular industrial lines of manufacture also have been affected but this results merely in making a larger part of outputs available for civilian use. For the greater part, production in general industrial fields shows no signs of a downward trend but in some cases there are hopes of increasing activities through a lessening in the manpower shortage.

The *Chem. & Met.* index for industrial consumption of chemicals dropped to 184.04 in April from a revised figure of 191.09 for March. Last year the comparable indexes were 180.76 and 189.49 respectively. With the exception of a falling off in operating rates at steel mills, unofficial reports for May indicate that the principal consuming industries are holding a steady rate and a new all-time high was reported for petroleum refining activities.

That total production of the country has fallen from its peak does not mean that manufacturing rates will not remain high even in the strictly wartime branches. The chairman of the War Production Board has stated that throughout the eight months after V-E day, munitions production, according to the existing program, will run at an annual rate of $54,000,000,000 or two-thirds as much as in 1942; almost equal to the rate of 1943; better than nine-tenths the rate in the peak of 1944; an equivalent to about 90 percent of the total value of manufactured goods in our best prewar year, 1937. Referring to jobs most likely to be affected by cutbacks, he included 300,000 now held by workers in the production of war chemicals.

Both production and consumption of some chemical products are affected by scarcities, inadequate supplies of raw materials curtailing outputs which in turn slows operations at consuming plants. Drying oils present a typical case where for a long time the supply has not been up to demand. Some improvement is anticipated as a result of an agreement reached with Argentina whereby the U. S. Commercial Co. is to purchase all of Argentina's exportable surplus of vegetable oil seeds and their products. Because of the shortage of fuel oil in the Argentine, flaxseed has been consumed in that country as a fuel. The new agreement provides that the United States will take the surplus flaxseed and will send fuel oil to the Argentine in exchange, the relative heat-producing capacity of the two products forming the basis of exchange.

In the rubber industry progress has been made in the use of the synthetic product without the admixture of crude rubber. If this practice becomes more general the demand for rubber chemicals will be expanded and new production facilities will be necessary for some of these chemicals. At present accelerators and anti-oxidants are in limited supply, most serious shortages being reported for aromatic thiazoles with prospective supplies appearing to be at least 3,000,000 lb. below requirements for the current year.

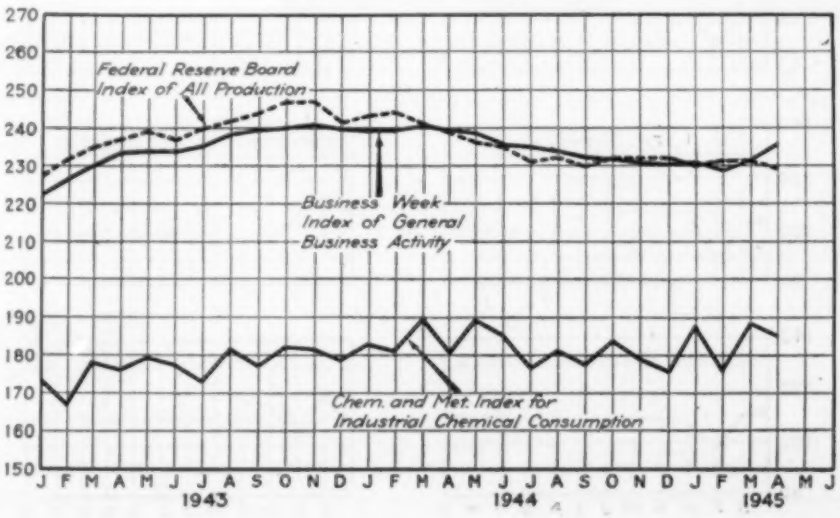
Foreign trade has been an important factor in pushing domestic chemical production to the high level reached in the last few years. This holds true not only for the shipment of chemicals as such but also because of the remarkable rise in export tonnage including many finished and semi-finished products which consume chemicals in their fabrication. The Department of Commerce has released figures covering export totals for some of the chemical groups which may prove helpful in considering the adjustment of chemical production to postwar conditions.

In terms of $1,000, the released data place exports in 1941 at $29,717 for coal-tar products; $63,263 for industrial chemicals; $17,150 for pigments; and $43,852 for medicinal and pharmaceutical products. For 1944 the totals were $36,337 for coal-tar products; $131,055 for industrial chemicals; $15,507 for pigments; and $105,925 for medicinal and pharmaceutical products. While a good part of the outward shipments were on private account, it is certain that the major share was on lend-lease account. Prospects for a larger-than-normal peacetime trade in chemicals with outside countries is generally regarded as favorable and the degree to which such trade exceeds the prewar standards will have considerable to do with establishing production rates at domestic plants.

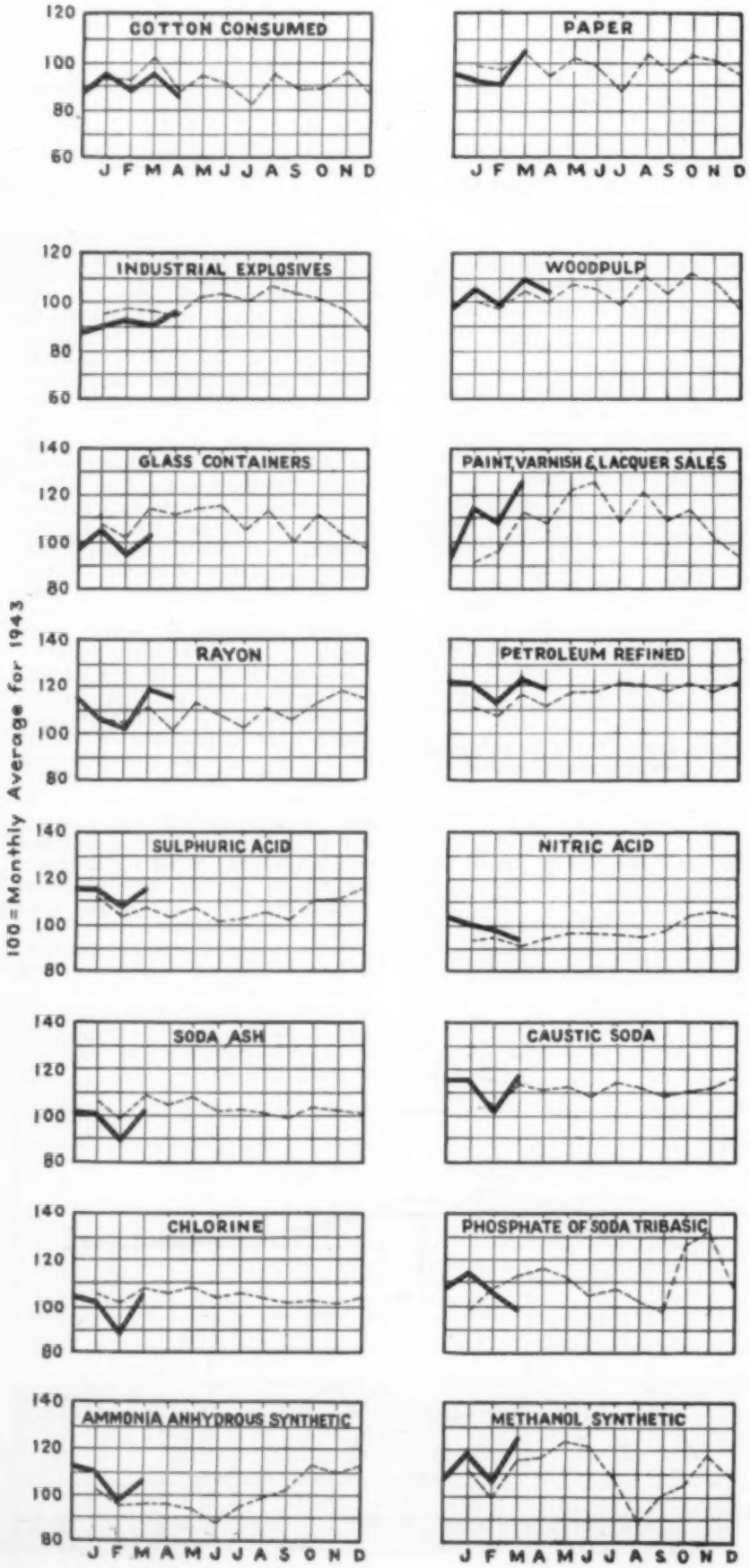
Chem. & Met. Index for Industrial Consumption of Chemicals

1935 = 100

	March revised	April
Fertilizers	40.98	40.49
Pulp and paper	19.98	18.51
Petroleum refined	19.19	18.52
Glass	19.70	19.00
Paint and varnish	19.38	18.50
Iron and steel	13.62	12.92
Rayon	18.87	18.37
Textiles	11.18	10.49
Coal products	10.50	9.57
Leather	4.60	4.50
Industrial explosives	5.09	5.27
Rubber	3.00	3.00
Plastics	5.00	4.90
	191.09	184.04



PRODUCTION AND CONSUMPTION TRENDS



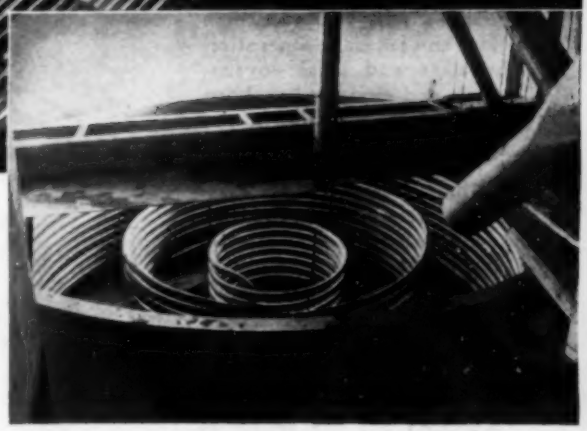
SINCE a large part of the rise in production of chemicals in the last four years has been due to the establishment of a war-created consuming industry, it naturally follows that the trend for chemical production will be downward as this temporary consuming outlet becomes narrower. The contraction is now gaining headway yet the trend is not general as evidenced by the fact that many chemicals are still very scarce and that for many products new productive facilities either have been completed or are under consideration.

New uses for chrome chemicals have been developed in the last few years and while the applications have been important in the military program, they will be carried over into the peacetime economy. A project has been approved for new production in Louisiana which will add about 20,000 tons to current annual capacity. Three new plants soon will enter upon production of phthalic anhydride with a fourth expected to operate early next year. In addition, capacities of some existing plants are being enlarged. Three new plants for hydrogen peroxide also have been given preferred ratings to expedite their completion. A new plant for production of amines is expected to start operations in July. Napthalene supplies soon will be increased through expanded plant facilities.

The superphosphate industry has discussed the possibility of expanding capacities for producing superphosphate and sulphuric acid. New acid plants are now under way which should bring production up to full requirements but if outputs at ordnance works should be discontinued or greatly curtailed, the supply for superphosphate use might prove inadequate. The current rate of producing sulphate of potash also gives concern and consideration is now given to the possibility of obtaining it from furnaces now producing salt cake and hydrochloric acid. At present the potash supply is not able to meet all requirements and industrial use has been cut by 10 percent in order to make larger amounts available for agriculture.

Call for industrial alcohol deliveries has been less insistent and outputs in the immediate future will drop largely as a result of the liquor holiday. It is probable that future needs for alcohol will be considerably under the estimates which were reached earlier in the year with petroleum satisfying a larger part of requirements in the synthetic rubber field. Incidentally, the goal for synthetic rubber production has been revised downwards and a drop of about 10 percent in output was registered for May as compared with April. In the first four months of this year, production amounted to 296,000 long tons but it now seems certain that this rate will not be maintained since military demands have been lessened and it is difficult to bring fabricating facilities up to a point where they could absorb the output of rubber as previously planned.

Chemical Companies prefer COPPER



BECAUSE of its high thermal conductivity, its easy workability, its resistance to attack by water and many chemicals, solvents and solutions, copper is a preferred metal for much plant equipment. In breweries and distilleries it has been considered the one essential metal for many centuries. There is a well-founded opinion that fermentation tanks of copper inhibit the growth of undesirable organisms, thus protecting flavor, quality and output.

Revere is a large supplier of copper and copper-base alloys to the chemical industries, producing plate, sheet and strip, pipe and tube, bar and rod and other mill products.

Where structural strength is desired in combination with corrosion resistance, Herculoy is often specified. This is a Revere copper-silicon alloy having the strength of mild steel plus the corrosion resistance of copper.

Ask the Revere Technical Advisory Service to work with you in selecting the proper Revere products. Get in touch with us or your local Revere distributor, or have your fabricator do so.

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Heat Exchangers	Catalyst Tubes
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Write Dept. C,
ALABAMA STATE CHAMBER OF COMMERCE,
Montgomery 1, Alabama

ALABAMA
STATE PLANNING BOARD
Montgomery 5, Alabama

United States Production of Certain Chemicals

March 1945, March 1944 and Three-Month Totals for 1945 and 1944

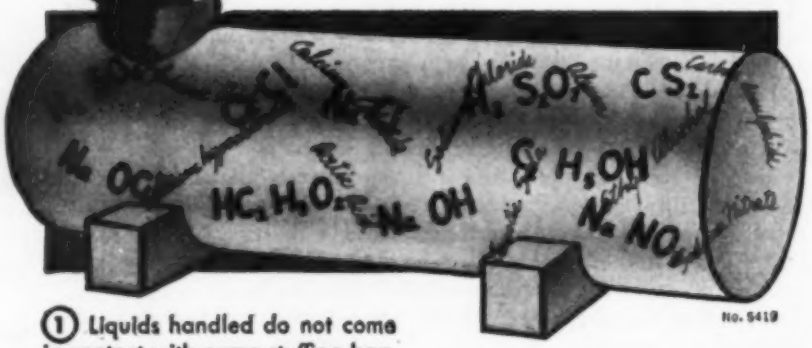
Chemical and Basis	Units	March 1945	March 1944	Total, First 3 Months 1945	Total, First 3 Months 1944
Acetylene:					
For use in chemical synthesis	M cu. ft.	290,704	329,681	912,888	972,399
For commercial purposes	M cu. ft.	144,283	154,084	417,695	446,761
Aluminum chloride:					
Anhydrous and crystal (100% $AlCl_3$)	M lb.	5,186	.....	15,303	.....
Solution (32° Be)	M lb.	993	.....	3,111	.....
Ammonia, synthetic anhydrous (100% NH_3)	Tons	49,089	.....	143,708	.....
Ammonium chloride, (100% NH_4Cl)	M lb.	5,538	.....	15,347	.....
Barium sulphate (Blanc fixe) (100% $BaSO_4$)	M lb.	3,966	.....	13,717	.....
Bleaching powder (35-37% avail. Cl_2)	M lb.	2,950	4,929	6,809	16,478
Calcium acetate (80% Ca $(C_2H_3O_2)_2$)	M lb.	583	1,048	1,828	3,293
Calcium arsenate (100% $Ca_3(AsO_4)_2$)	M lb.	3,006	3,392	5,810	9,890
Calcium carbide (commercial)	Tons	62,753	68,653	181,241	191,634
Calcium hypochlorite (true) (70% avail. Cl_2)	M lb.	1,377	1,228	3,817	3,504
Calcium phosphate:					
Monobasic (100% $CaH_4(PO_4)_2$)	M lb.	6,032	6,064	16,060	16,966
Dibasic (100% $CaHPO_4$)	M lb.	3,807	.....	10,909	.....
Carbon, activated	M lb.	5,205	.....	14,750	.....
Carbon black (channel):					
Rubber grade	M lb.	38,039	.....	106,604	.....
Other than rubber grade	M lb.	2,539	.....	7,503	.....
Carbon dioxide:					
Liquid and gas	M lb.	19,622	30,008	52,470	79,715
Solid (dry ice)	M lb.	51,977	49,460	135,269	129,213
Chlorine	Tons	107,466	108,524	303,485	316,232
Chrome green (C.P.)	M lb.	525	463	1,717	1,538
Chrome yellow and orange (C.P.)	M lb.	3,610	.....	9,944	.....
Copper acetoarsenite (Paris green)	M lb.	266	.....	1,258	.....
Hydrochloric acid (100% HCl)	Tons	37,639	29,475	106,465	87,114
Hydrogen	M cu. ft.	2,063,000	2,091,000	6,078,000	5,904,000
Hydrogen peroxide (100 volumes)	M lb.	2,738	.....	7,911	.....
Iron blue (C.P.)	M lb.	779	.....	2,338	.....
Lamp black	M lb.	1,190	.....	3,397	.....
Lead arsenate (acid and basic)	M lb.	8,241	10,283	24,404	25,180
Lead oxide:					
Red (C.P.)	M lb.	9,171	9,287	25,218	26,958
Yellow (C.P.)	M lb.	29,392	.....	85,471	.....
Methanol:					
Natural (80% CH_3OH)	M gal.	305	363	901	1,085
Synthetic (100% CH_3OH)	M gal.	6,791	6,270	19,073	17,696
Molybdate chrome orange (C.P.)	M lb.	129	164	366	403
Nitric acid (100% HNO_3)	Tons	37,962	36,509	118,905	112,283
Nitrous oxide	M gal.	13,236	11,567	36,882	27,100
Oxygen	M cu. ft.	1,475,789	1,696,487	4,216,095	4,796,606

(*Continued on page 240*)

Since 1859

THIS **VERTICAL** PUMP

Oleum, Concentrated Sulphuric and Mixed Acids, are successfully handled in a practical manner by Taber VERTICAL Pumps, because:



No. 5419

(1) Liquids handled do not come in contact with pump stuffing box.

(2) To compensate for non-lubricating properties of liquid or other chemical solutions pumped, larger bearings are used.

(3) Repacking interruptions are reduced to the lowest minimum.

(4) Damaging vibration is prevented by larger shaft diameters.

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Dynamic fighting forces need static supplies, materials and supplies that never vary in quality. Stauffer, whose products for more than sixty years have been famous for their uniformly high quality, has been proud to do its part in supplying war industries with quality chemicals in sufficient quantities to keep our fighting men on the move. Out of Stauffer's vast experience in the chemical world has come the versatility and knowledge that enables it to supply industry with chemicals for aircraft, bombs, ships, tanks, high octane gas, rubber, parachutes and many other items of materiel. Stauffer—all-out wartime production now—all-out peacetime production after victory.

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Carbon Bisulphide
Carbon Tetrachloride
Caustic Soda
Citric Acid
*Copperas
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This generator or electrolyzer produces 99% pure O_2 and 99.5% pure H_2, safely and economically at uniform density. Efficiency — 3½ cu. ft. O_2 and 7 cu. ft. H_2 per KWH. in desired capacity.

For electrolytic reduction of compounds, this Electrolyzer offers the possibility of increased efficiency by operating under pressure plus the recovery of useful oxygen and hydrogen.

Write for Bulletin 118.

T. SHRIVER & COMPANY, Inc.
802 Hamilton St. Harrison, N. J.

U. S. Chemical Production (Cont. from p. 238)

Chemical and Basis	Units	March 1945	March 1944	Total, First 3 Months 1945	Total, First 3 Months 1944
Phosphoric acid (50% H_3PO_4)	Tons	53,381	65,484	155,973	192,374
Potassium bichromate and chromate (100%)	M lb.	686	676	1,841	2,153
Potassium hydroxide (100% KOH)	Tons	4,735	4,016	12,672	10,936
Soda ash (commercial sodium carbonate):					
Ammonia-soda process (98-100% Na_2CO_3):					
Total wet and dry[4]	Tons	380,371	399,758	1,078,041	1,157,107
Finished light[5]	Tons	218,540	218,657	575,985	641,276
Finished dense	Tons	103,639	126,886	336,332	361,133
Natural[6]	Tons	15,156	13,778	43,193	41,033
Sodium bicarbonate (refined) (100% $NaHCO_3$)	Tons	15,570	15,089	39,736	42,361
Sodium bicarbonate and chromate (100%)	Tons	7,466	7,511	20,457	21,628
Sodium bisulphite (100% $NaHSO_3$)	M lb.	3,771	.....	9,166	.....
Sodium hydrosulphide (100% NaSH)	M lb.	1,907	.....	5,192	.....
Sodium hydrosulphite (100% $Na_2S_2O_4$)	M lb.	3,367	.....	9,696	.....
Sodium hydroxide (100% NaOH):[9]					
Electrolytic process					
Liquid	Tons	101,332	101,349	287,288	216,247
Solid	Tons	19,304	.....	56,885	.....
Lime-soda process					
Liquid	Tons	66,111	87,625	187,510	168,330
Solid	Tons	19,976	.....	59,233	.....
Sodium phosphate:					
Monobasic (100% NaH_2PO_4)	Tons	1,255	2,513	3,230	7,114
Dibasic (100% Na_2HPO_4)	Tons	4,554	4,850	13,185	13,497
Tribasic (100% Na_3PO_4)	Tons	6,015	6,855	19,346	19,350
Meta (100% $NaPO_3$)	Tons	2,437	.....	6,348	.....
Tetra (100% $Na_4P_2O_7$)	Tons	2,827	.....	8,747	.....
Sodium silicate: soluble silicate glass, liquid and solid (anhydrous)	Tons	37,105	.....	109,077	.....
Sodium sulphate:					
Anhydrous (refined) (100% Na_2SO_4)	Tons	8,163	6,408	20,831	23,688
Glaubers salt (100% $Na_2SO_4.10H_2O$)	Tons	18,153	.....	52,832	.....
Salt cake (crude) (commercial)	Tons	48,788	.....	137,094	.....
Sulphur dioxide	M lb.	6,737	5,969	19,382	17,675
Sulphuric acid (100% H_2SO_4):[4]					
Chamber process	Tons	275,920	275,317	849,711	846,687
Net contact process[6]	Tons	497,487	438,867	1,425,470	1,301,769
White lead:					
Basic lead carbonate (C.P.)	Tons	2,916	.....	10,182	.....
Basic lead sulphate (C.P.)	Tons	1,152	.....	2,977	.....
Zinc yellow (zinc chromate) (C.P.)	Tons	1,709	.....	4,476	.....

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census and WPB Chemicals Bureau. Production figures represent primary production and do not include purchased or transferred material. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry not included. Chemicals manufactured by TVA, however, are included. All tons are

(Footnotes continued on p. 242)

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Simplicity of design . . . economy of operation are two prime features of *Royal Crown Pump Valves* for reciprocating pumps.

No springs, clips or keys to wear or get out of order. Just three sturdy trouble-free parts. The Cage, Valve and Seat.

The valve and seat are perfectly lapped at the factory and designed in such a way that there are an endless possible number of seats. Each time the valve closes in a new position it serves to lap in the valve and seat—one more reason for the extra long life of *Royal Crown Valves*.

For day-in and day-out performance . . . for increased efficiency . . . for increased pump volume at decreased pump speeds may we suggest you investigate *Royal Crown Valves*.

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Extra heavy cage serves as a guide for valve stem. Holds valve in perfect alignment with seat which prevents "cracking" open. Wiring eyes are provided to interlock the valve cluster.

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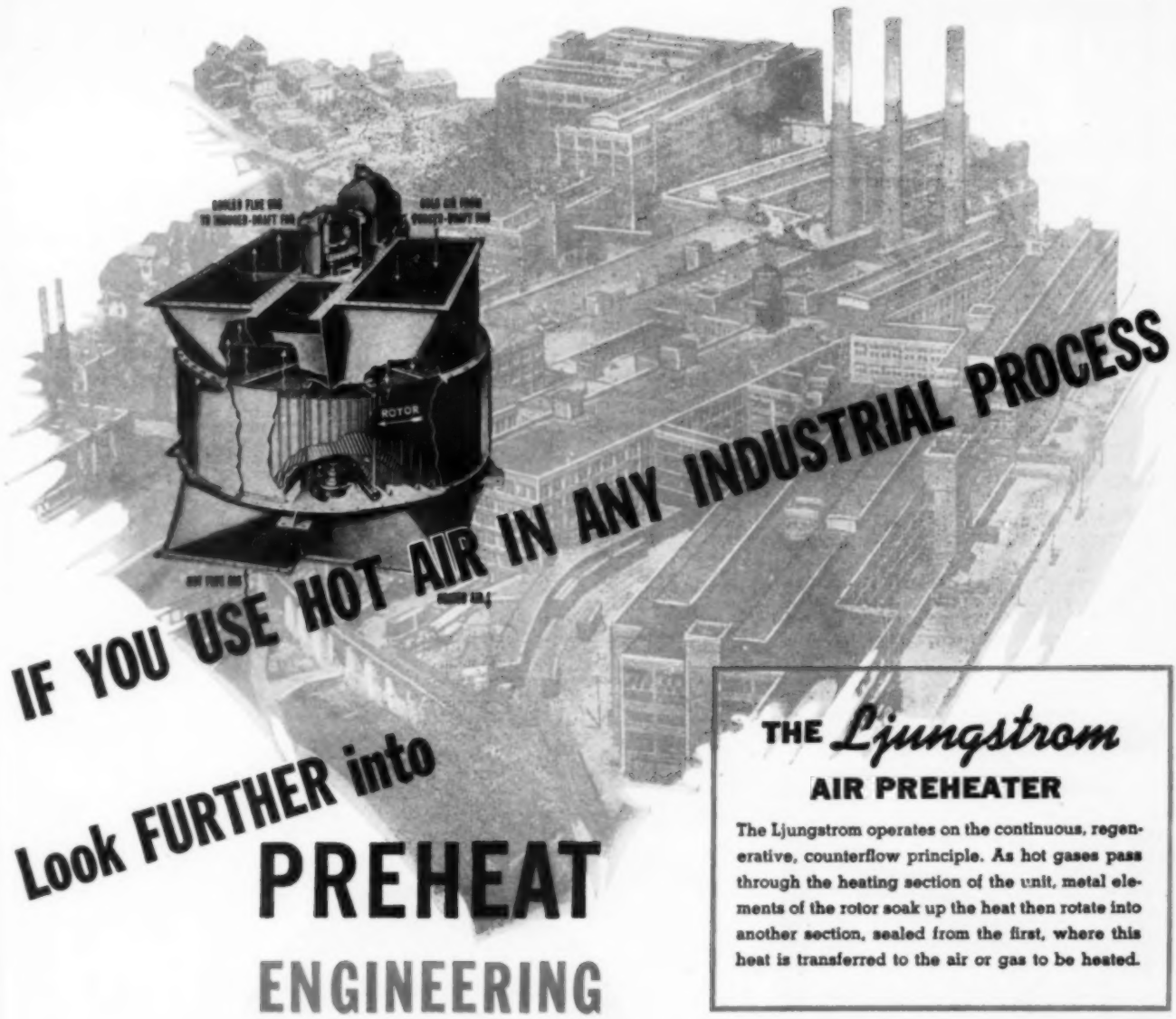

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The Ljungstrom operates on the continuous, regenerative, counterflow principle. As hot gases pass through the heating section of the unit, metal elements of the rotor soak up the heat then rotate into another section, sealed from the first, where this heat is transferred to the air or gas to be heated.

In addition to its contribution to higher heat recovery in steam generation, the Ljungstrom Air Preheater has other important industrial applications. If your process requires, or can use to advantage, preheated air or gas up to 1,400 deg. F., it will pay you to investigate the possibilities of the Ljungstrom.

Today, preheat engineering is improving copper smelting, aiding operation of waste disposal plants, lowering the cost of production of synthetic rubber. Chemical and metallurgical industries are exploring its potentialities as applied to all their processes employing heated air or other heated gases. Dehydrating plants, too, are looking further into its possibilities.

ENGINEERING SERVICE

The engineering staff of The Air Preheater Corporation is prepared to assist you in applying standard or special types of Ljungstrom preheaters to combustion improvement or to other, newer, uses. So that you may benefit from designing the Ljungstrom into your plant or process, call in the preheat engineer while plans are still in the formative stage.

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U. S. Chemical Production (Cont. from p. 240)

2,000 lb. Where no figures are given, data are either confidential or not yet available. [1] Includes a small amount of aqua ammonia. [2] Total wet and dry production including quantities diverted for manufacture of sodium bicarbonate and caustic soda and quantities processed to finished light and finished dense. [3] Not including quantities converted to finished dense. [4] Data collected in cooperation with the Bureau of Mines. [5] Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6] Include oleum grades. Excludes spent acid.

United States Production of Certain Synthetic Organic Chemicals

March 1945, March 1944 and Three-Month Totals for 1945 and 1944

Item	March 1945	March 1944	Total, First 3 Months 1945	Total, First 3 Months 1944
Acetanilide, technical and U. S. P.	620,502	699,295	1,111,467*	1,738,015
Acetic acid, synthetic[1]	23,266,187	27,719,588	71,495,021	76,789,529
Acetic acid, natural[2]	2,811,107	3,289,140	8,816,162	10,140,231
Acetic anhydride	47,675,185	41,686,408	134,231,622	120,372,556
Acetylsalicylic acid, aspirin	924,117	829,951	2,626,831	2,347,843
n-Butyl acetate	3,325,700	7,913,081	14,524,468	19,844,144
Creosote oil, tar distillers[3]	12,568,662	11,633,703	32,559,582	34,173,469
Creosote oil, byproduct[4, 5]	3,463,613	2,983,970	9,560,523	9,185,754
Cresols, meta-para[3]	589,326	537,482	1,747,918	1,748,520
Cresols, ortho-meta-para[3]	881,504	971,533	2,414,522	2,314,583
Cresylic acid, crude	2,377,914	2,014,785	6,681,010	6,217,814
Cresylic acid, refined[3]	2,574,060	3,737,173	7,984,329	10,208,743
Diethyl ether, all grades	8,082,245	5,547,268	22,812,742	14,732,245
Ethyl acetate, 85 percent	9,244,430	10,176,203	27,416,964	29,106,776
Lactic acid, edible	381,994	304,732	1,220,500	1,021,020
Lactic acid, technical	428,627	256,698	1,319,343	818,510
Methyl chloride, all grades	2,688,205	1,990,710	7,538,986	4,599,819
Naphthalene, coke-oven[6, 7]	7,934,492	8,682,110	22,179,483	27,171,990
Naphthalene, tar distillers[7, 8]	18,168,471	17,616,262	49,381,659	48,433,719
Naphthalene, refined[3]	5,745,529	8,180,156	16,482,062	23,217,014
Oxalic acid, technical	1,720,416	1,517,309	5,022,794	4,455,528
Phenobarbital and sodium salts	32,047	20,797	73,162	68,642
Phthalic anhydride	11,373,340	10,345,136	31,225,737	29,226,378
Sulfa drugs, total[10]	538,822	630,775	1,365,053	1,948,389

Statistics collected and compiled by the U. S. Tariff Commission except where noted. In pounds except that creosote oil is expressed in gallons. [1] Excludes recovered acetic acid. [2] Acetic acid produced by direct process from wood and from calcium acetate. Compiled by Bureau of Census. [3] Product of distillers of purchased tar only. [4] Product of byproduct coke-oven operators only. [5] Statistics collected and compiled by Coal Economics Division, U. S. Bureau of Mines. [6] Statistics reported by byproduct coke-oven operators combined with those reported by tar distillers to prevent disclosure of operations of individual companies. [7] Statistics combine three grades: solidfying at less than 74; 74 to less than 76; and 76 to less than 79 deg. C. [8] Production for sale only in case of less than 74 grade. Production both for consumption within producing plant and for sale in case of other two grades. [9] 79 deg. C. and over. [10] Includes data for acetylsulfathiazole, both as drug and as intermediate, resulting in appreciable unavoidable duplication. * Two month total, Jan. figure confidential.

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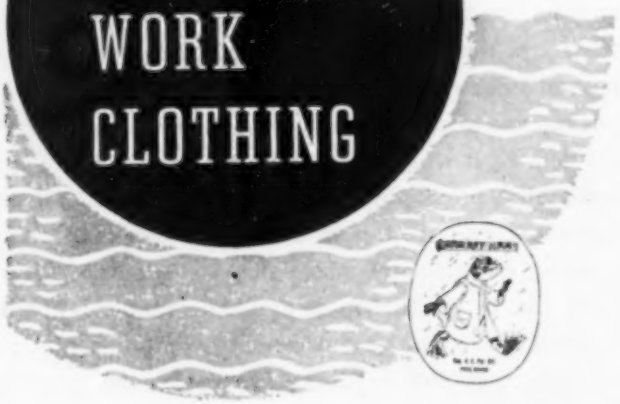

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4. Elimination of "red water", consequently of staining and contamination of products
5. Lower pumping costs

Rusticon Liquid Silicate Process of Water Corrosion Control operates independently of water analysis. Hence, industrial plants solve corrosion problems with the easy-to-feed Rusticon Silicates. Automatic feeders deliver a definite quantity of silicate for protection, based on the flow of water or the action of the pumps.

Let's talk over your water corrosion problem. For more complete information and typical installation details for the Rusticon Silicate Process, write us.

PHILADELPHIA QUARTZ CO.

Dept. A, 119 South Third Street, Phila. 6, Pa.
Chicago Sales Office: 205 West Wacker Drive
Distributors in over 65 Cities • 9 PQ Plants

PQ SILICATES OF SODA

CHEM. & MET. Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

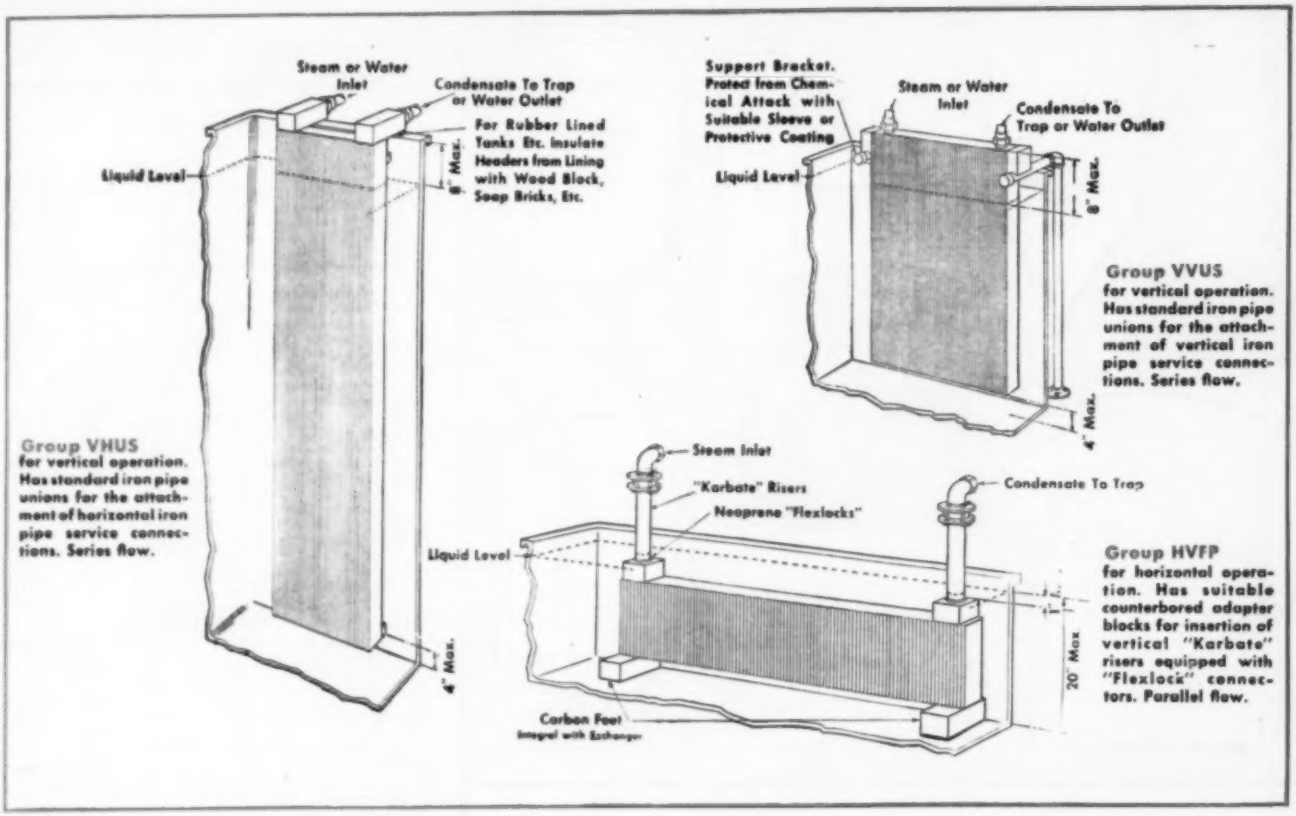
This month	**108.93**
Last month	108.97
June, 1944	109.59
June, 1943	109.01

CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to June 12.

INDUSTRIAL CHEMICALS

Acetone, tanks, lb.	$0.07 –
Acid, acetic, 28%, bbl., 100 lb.	3.38 – $3.63
Boric, bbl., ton	109.00 –113.00
Citric, kegs, lb.	.20 – .23
Formic, cbys., lb.	.10½– .11
Hydrofluoric, 30%, drums, lb.	.08 – .085
Lactic, 44%, tech. light, bbl., lb.	.073– .075
Muriatic, 18°, tanks, 100 lb.	1.05 –
Nitric, 36°, carboys, lb.	.05 – .05½
Oleum, tanks, wks., ton	18.50 – 20.00
Oxalic, crystals, bbl., lb.	.11½– .12½
Phosphoric tech., tanks, lb.	.04 –
Sulphuric, 60°, tanks, ton	13.00 –
Tartaric, powd., bbl., lb.	.70½–
Alcohol, amyl	–
From pentane, tanks, lb.	.131–
Alcohol, butyl, tanks, lb.	.10½– .18½
Alcohol, ethyl, denatured, 190 proof	–
No. 1 special, tanks, gal., wks.	.50 –
Alum, ammonia, lump, lb.	.04½–
Aluminum sulphate, com. bags 100 lb.	1.15 – 1.40
Ammonia, anhydrous, cyl., lb.	.14½–
tanks, ton	50.00 – 60.00
Ammonium carbonate, powd., tech., casks, lb.	.09½– .12
Sulphate, wks., ton	28.20 –
Amyl acetate, tech., from pentane, tanks	.145–
Aqua ammonia, 26°, drums, lb.	.02½– .03
tanks, ton	65.00 –
Arsenic, white, powd., bbl., lb.	.04 – .04½
Barium carbonate, bbl., ton	65.00 – 75.00
Chloride, bbl., ton	75.00 – 78.00
Nitrate, casks, lb.	.09½– .11
Blanc fix, dry, bags, ton	60.00 – 70.00
Bleaching powder, f.o.b. wks., drums, 100 lb.	2.50 – 3.00
Borax, gran., bags, ton	45.00 –
Calcium acetate, bags	3.00–
Arsenate, dr., lb.	.07½– .08
Carbide, drums, ton	50.00 –
Chloride, flake, bags, del., ton	18.50 – 25.00
Carbon bisulphide, drums, lb.	.05 – .0 ½
Tetrachloride, drums, gal.	.73 – .8
Chlorine, liquid, tanks, wks., 100 lb.	1.75 – 2.00
Copperas, bgs., f.o.b. wks., ton	17.00 – 18.00
Copper carbonate, bbl., lb.	.19½– .20
Sulphate, bbl., 100 lb.	5.00 – 5.50
Cream of tartar, bbl., lb.	.57 –
Diethylene glycol, dr., lb.	.14½– .15½
Epsom salt, dom., tech., bbl., 100 lb.	1.80 – 2.00
Ethyl acetate, tanks, lb.	.11½–
Formaldehyde, 40%, tanks, lb.	.032–
Furfural, tanks, lb.	.09½–
Glaubers salt, bags, 100 lb.	1.05 – 1.10
Glycerine, c.p., drums, extra, lb.	.17½– .17½
Lead:	
White, basic carbonate, dry, casks, lb.	.08½–
Red, dry, sck., lb.	.09½–
Lead acetate, white crys., bbl., lb.	.12½– .13
Lead acetate, powd., bag, lb.	.11½– .12
Lithopone, bags, lb.	.04½– .04½
Magnesium carb., tech., bags, lb.	.06½– .06½
Methanol, 95%, tanks, gal.	.58 –
Synthetic, tanks, gal.	.24 –
Phosphorus, yellow, cases, lb.	.23 – .25
Potassium bichromate, casks, lb.	.10½– .10½
Chlorate, powd., lb.	.09½– .12
Hydroxide (c'stic potash) dr., lb.	.07 – .07½
Muriate, 60%, bags, unit	.53½–
Nitrate, bbl., lb.	.05½– .06
Permanganate, drums, lb.	.19½– .20
Prussiate, yellow, casks, lb.	.16 – .17
Sal ammoniac, white, casks, lb.	.0515– .06
Salsoda, bbl., 100 lb.	1.00 – 1.05
Salt cake, bulk, ton	15.00 –
Soda ash, light, 58%, bags, contract, 100 lb.	1.05 –
Dense, bags, 100 lb.	1.15 –
Soda, caustic, 76% solid, drums, 100 lb.	2.30 – 3.00
Acetate, del., bbl., lb.	.05 – .06
Bicarbonate, bbl., 100 lb.	1.70 – 2.00
Bichromate, casks, lb.	.07½– .08½
Bisulphate, bulk, ton	16.00 – 17.00
Bisulphite, bbl., lb.	.03 – .04


Steam or Water Inlet
Condensate To Trap or Water Outlet
For Rubber Lined Tanks Etc. Insulate Headers from Lining with Wood Block, Soap Bricks, Etc.
Liquid Level
8" Max.
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for vertical operation. Has standard iron pipe unions for the attachment of horizontal iron pipe service connections. Series flow.
4" Max.
Support Bracket. Protect from Chemical Attack with Suitable Sleeve or Protective Coating
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Condensate To Trap or Water Outlet
Liquid Level
8" Max.
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4" Max.
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"Karbate" Risers
Neoprene "Flexlocks"
Condensate To Trap
Liquid Level
20" Max
Carbon Feet
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That is, the requirements for a heater or cooler of corrosive liquids in tanks for pickling, etching, plating, cleaning, or other services in the chemical and metal industries.

You'll say:

Resistance to strong corrosive chemicals.
High heat transfer ability.
Strength.
Shock resistance, both mechanical and thermal.
Adaptability to your tanks.
Convenient mountings and connections.

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Within each unit tubular channels are provided for the heating or cooling medium. On the exterior, corrugations provide maximum surface for heat transfer. Finished assemblies come with various types of mountings and adaptable, easy-to-assemble connections.

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Unit of Union Carbide and Carbon Corporation

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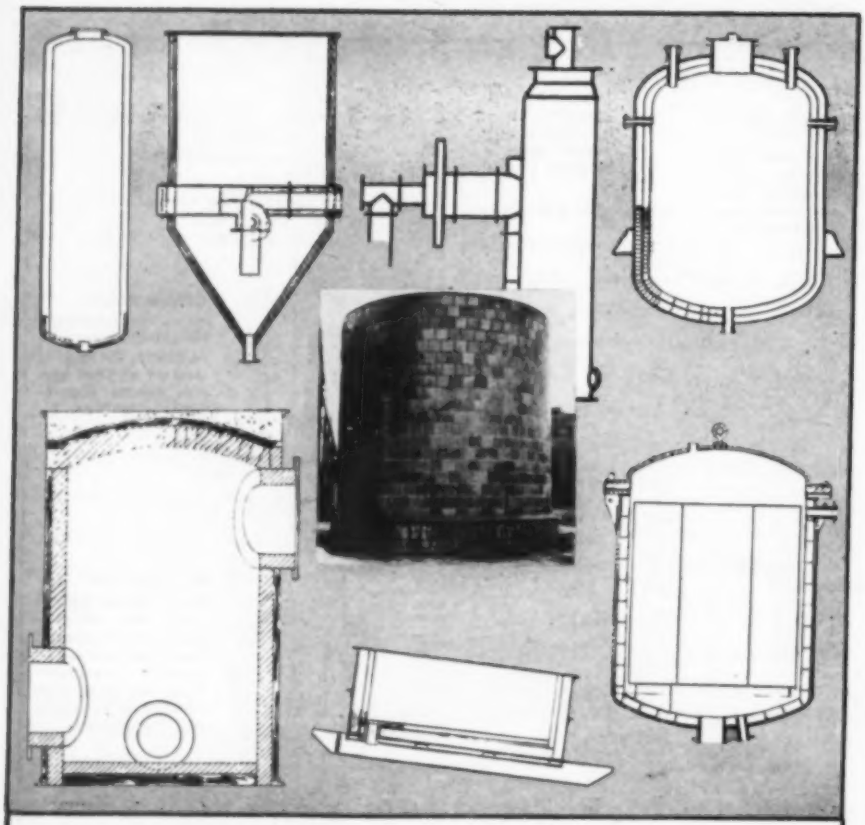

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LINING AND TILE TANK SERVICE

ONE Source of Supply

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ONE Standard of Quality

Stebbins offers a complete service in design, installation, maintenance and repair of corrosion-resistant linings, both for acid and alkali conditions. We specialize in the heavier type of linings, which are built of brick, tile, porcelain and carbon materials. Where conditions require, we offer synthetic resin membranes, resistant coatings and rubber films in combination with brickwork. The business of this organization is devoted exclusively to linings and tile tanks.

Stebbins service, based on 61 years of experience in producing linings and tile tanks exclusively, extends not only throughout the North American continent, but—by virtue of full export facilities—to Central and South America, and the Orient as well. In the United States and Canada, crews of trained men, stationed at various locations, are available to handle maintenance and repair problems.

SEMCO

Stebbins Engineering and Manufacturing Company

367 EASTERN BOULEVARD, WATERTOWN, NEW YORK

CHEM & MET.
Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

This month	145.85
Last month	145.85
June, 1944	145.24
June, 1943	145.55

Chlorate, kegs, lb	$0.06½ –	$0.06½
Cyanide, cases, dom., lb	.14 –	.15
Fluoride, bbl., lb	.07 –	.08
Hyposulphite, bbl., l.c.l.	2.40 –	2.50
Metasilicate, bbl., 100 lb	2.50 –	2.65
Nitrate, bulk, 100 lb	1.35 –	
Nitrite, casks, lb	.06½ –	.07
Phosphate, tribasic, bags, lb	2.70 –	
Prussiate, yel., bags, lb	.09½ –	.10
Silicate, 40°, dr., wks., 100 lb	.80 –	.85
Sulphide, bbl., lb	.02½ –	
Sulphite, crys, bbl., lb	.02½ –	.02¾
Sulphur, crude at mine, long ton	16.00 –	
Dioxide, cyl., lb	.07 –	.08
Dioxide, tanks, lb	.04 –	
Tin crystals, bbl., lb	.39½ –	
Zinc chloride, gran, bbl., lb	.05½ –	.06
Oxide, lead free, bag, lb	.07½ –	
Oxide, 5% leaded, bags, lb	.07½ –	
Sulphate, bbl., cwt	3.85 –	4.00

OILS AND FATS

Castor oil, No. 3 bbl., lb	$0.13½ –	$0.14½
Chinawood oil, tanks, lb	.38½ –	
Coconut oil, ceylon, dr. N. Y., lb.	.0885 –	
Corn oil crude, tanks (f.o.b. mill), lb	.12½ –	
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12½ –	
Linseed oil, raw, car lots, bbl., lb.	.155 –	
Palm, casks, lb	.0865 –	
Peanut oil, crude, tanks (mill), lb.	.13 –	
Rapeseed oil, refined, bbl., lb	nom.	
Soybean, tank, lb	.11½ –	
Menhaden, light pressed, dr., lb	.13½ –	
Crude, tanks (f.o.b. factory) lb.	.089 –	
Grease, yellow, loose, lb	.08½ –	
Oleo stearine, lb	.09½ –	
Oleo oil, No. 1, lb	.11½ –	
Red oil, distilled, bbl., lb	.12½ –	
Tallow extra, loose, lb	.08½ –	

COAL-TAR PRODUCTS

Alpha-naphthol, crude, bbl., lb	$0.52 –	$0.55
Alpha-naphthylamine, bbl., lb	.32 –	.34
Aniline oil, drums, extra, lb	.15 –	.16
Aniline salts, bbl., lb	.22 –	.24
Benzaldehyde, USP, dr., lb	.85 –	.95
Benzidine base, bbl., lb	.70 –	.75
Benzoic acid, USP, kegs, lb	.54 –	.56
Benzol, 90%, tanks, works, gal	.15 –	
Benzyl chloride, tech., dr., lb	.23 –	.25
Beta-naphthol, tech., drums, lb	.23 –	.24
Cresol, USP, dr., lb	.11 –	
Cresylic acid, dr., wks., gal	.81 –	.83
Diphenyl, bbl., lb	.15 –	
Diethylaniline dr., lb	.40 –	.45
Dinitrotoluol, bbl., lb	.18 –	.19
Dinitrophenol, bbl., lb	.22 –	.23
Dip oil, 15%, dr., gal	.23 –	.25
Diphenylamine, dr. f.o.b. wks., lb	.60 –	
H acid, bbl., lb	.45 –	.50
Hydroquinone, bbl., lbp	.90 –	
Naphthalene, flake, bbl., lb	.07 –	.07½
Nitrobenzene, dr., lb	.08 –	.09
Para-cresol, bbl., lb	.41 –	
Para-nitraniline, bbl., lb	.47 –	.49
Phenol, USP, drums, lb	.10½ –	.11
Picric acid, bbl., lb	.35 –	.40
Pyridine, dr., gal	1.70 –	1.80
Resorcinol, tech., kegs, lb	.75 –	.80
Salicylic acid, tech., bbl., lb	.26 –	.33
Solvent naphtha, w.w., tanks, gal.	.27 –	
Tolidine, bbl., lb	.96 –	.98
Toluol, drums, works, gal	.33 –	
Zylol, com., tanks, gal	.26 –	

MISCELLANEOUS

Casein, tech., bbl., lb	$0.18 –	$0.23
Dry colors		
Carbon gas, black (wks.), lb	.0335 –	.30
Prussian blue, bbl., lb	.36 –	.37
Ultramarine blue, bbl., lb	.11 –	.26
Chrome green, bbl., lb	.23 –	.33
Carmine, red, tins, lb	4.60 –	4.75
Para toner, lb	.75 –	.80
Vermilion, English, bbl., lb	2.75 –	2.80
Chrome, yellow, C. P., bbl., lb.	.16 –	.17
Gum copal, Congo, bags, lb	.09 –	.55
Manila, bags, lb	.09 –	.15
Damar, Batavia, cases, lb	.10 –	.22
Kauri, cases, lb	.18 –	.60
Magnesite, calc, ton	64.00 –	
Pumice stone, lump, bbl., lb	.05 –	.07
Rosin, H., 100 lb	7.00 –	
Shellac, orange, fine, bags, lb	.39 –	
Bleached, bonedry, bags, lb	.39 –	
T. N. bags, lb	.31 –	
Turpentine, gal	.90 –	

"Aye Mon, we *Multiwalls* are a thrifty lot!"

It's a fact, Multiwall Paper Bags are thrifty on three separate counts.

In Your Customers' Plants

1. These tight, siftproof bags deliver 100% of your product . . . eliminate siftage losses while helping to keep storerooms clean.

2. Multiwalls empty clean. Materials do not cling to their smooth interior walls. Retention losses are, therefore, greatly reduced.

In Your Plant

3. St. Regis Bag Packaging Systems speed up weighing, filling and closing operations . . . save manpower and cut down labor costs.

In addition, Multiwall Paper Bags are easy to handle. Results have shown that *one man* can load and stack Multiwall bags as fast as *two men* can handle equal tonnage in heavy fabric sacks or drums.

And, Multiwalls are plenty tough. Made of from 2 to 6 plies of sturdy kraft paper and specially treated sheets . . . designed to meet specific conditions involving excessive dampness, infestation and rough handling.

Get All the Facts

If you are not already using Multiwall Paper Bags, find out how they can help solve your packaging problems. Write for full information *today*.

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NEW CONSTRUCTION

PROPOSED WORK

Ark., Jonesboro—Hargrove Industries, Inc., Jonesboro, plans to construct a soybean crushing plant and cotton seed oil mill. Estimated cost $150,000.

Colo., Denver—Denver Glass Bottle Co., 3557 Wazee St., plans to construct a 1 and 2 story, 60x100 ft. and 56x60 ft. L-shaped factory. Eugene G. Groves, Temple Court Bldg., Archt. Estimated cost between $75,000 and $100,000.

Conn., Plainfield—Plastic Film Corp., c/o Leo F. Caproni, Archt., 1221 Chapel St., New Haven, plans to construct a 1 story, 42x200 ft. addition to its factory, also four silos and platform 30x100 ft. Estimated cost $45,000.

Conn., Stamford—Electronic Rubber Co., 69 Sunnyside Ave., is having plans prepared by D. Mansell, Archt., 24 Park Row, for the construction of a 1 story factory and boiler plant on Fairfield Ave.

Ill., Barrington—Pure Oil Co., 35 East Wacker Dr., Chicago, plans to construct an experimental laboratory. Estimated cost $1,000,000.

Ill., Belvidere—Belvidere Distilling Co., 22 North Wells St., Chicago, and 310 Columbia Ave., Belvidere, is having plans prepared by United Engineers & Constructors, Inc., 1401 Arch St., Philadelphia, Pa., for the construction of a feed recovery plant.

La., Baton Rouge—Ethyl Corp., Baton Rouge, 100 North 21st St., plans improvements to its Ethyl chloride manufacturing plant. Estimated cost will exceed $60,000.

Mass., Mansfield—H & C Laboratories, 500 School St., plan the construction of a chemical plant. Estimated cost will exceed $40,000.

Mich., Wyandotte—Wyandotte Chemicals Corp., Biddle Ave., is having plans prepared by Henry F. Stanton, Archt., 409 Griswold St., and George Wagschall, Engr., 1131 Majestic Bldg., both Detroit, for a 2 story laboratory and office building. Estimated cost $150,000.

O., Cincinnati—Dinkel Corp., 4701 Paddock Rd., Cincinnati, plans to construct a chemical manufacturing plant. Estimated cost $220,000.

O., Ironton—Allied Chemical & Dye Corp., South Third Ave., plans to construct a phthalic anhydride plant and install equipment. Estimated cost $997,550.

Ore., Portland—Westcraft Paint Co., c/o Preservative Paint Co., 5410 Airport Way, Seattle, Wash., plans to construct a 2 story, 60x90 ft. factory building and a 40x50 ft. warehouse. Wolff & Phillips, Pearson 4th Ave. Bldg., Portland, Archts. Estimated cost $50,000.

Tex., Houston—Nyotex Chemical Co., Esperson Bldg., is having plans prepared by Howe & Wise, Engrs., 610 Stewart Bldg., for the construction of a 1 story addition to its chemical plant at Greens Bayou. Estimated cost $100,000.

	Current Projects		Cumulative 1945	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$125,000	$137,000	$2,210,000	$2,912,000
Middle Atlantic	.....	160,000	4,742,000	12,092,000
South	60,000	400,000	18,388,000	21,683,000
Middle West	6,408,000	.....	9,283,000	24,521,000
West of Mississippi	335,000	2,625,000	53,605,000	81,044,000
Far West	95,000	587,000	3,695,000	4,250,000
Canada	179,000	742,000	7,444,000	1,841,000
Total	$3,202,000	$8,651,000	$99,367,000	$148,343,000

Wash., Hoquiam—Rayonier, Inc., White Bldg., 4th and Union Sts., Seattle, Wash., plans alterations and additions to its pulp plant. Estimated cost $45,000.

Ont., Hamilton—Canadian Industries, Ltd., Box 10, Montreal, Que., Can., is having plans prepared for additions to its plant. Estimated cost $49,300.

Ont., Toronto—Fine Chemicals of Canada, Ltd., 587 Fleet St., is having plans prepared by W. A. Armstrong, Archt., 19 Melvida St., for the construction of a factory on Pharmacy Ave. Estimated cost $90,000.

Ont., Toronto—Huron Chemical Co., Ltd., c/o J. P. Arnott, 320 Bay St., plans to construct a factory. Estimated cost $40,000.

CONTRACTS AWARDED

Conn., Stamford—Atlas Powder Co., 269 Ludlow St., has awarded the contract for the construction of a 2 story, 40x100 ft. plant to Samworth-Hughes Co., 177 Van Houten St., Paterson, N. J., at $42,000.

Ky., Midway—Park & Tilford Distillers of Kentucky, Inc., 35th and Tyler Sts., Louisville, has awarded the contract for the construction of a feed recovery plant to J. D. Jennings, 17th and Breckenridge Sts., Louisville. Estimated cost $350,000.

Mass., Indian Orchard—Monsanto Chemical Co., 704 Monsanto Ave., has awarded the contract for an addition to its plant to J. G. Roy & Sons Co., 21 Silver St., Springfield. Estimated cost $55,000.

Mass., Pittsfield—General Electric Co., 1 Plastics Ave., has awarded the contract for the construction of a 1 story plastics plant, including laboratory and machine shop to Ernest J. Cramer, 28 North St., Pittsfield. Estimated cost $40,000.

Okla., Wynnewood—Kerlyn Oil Co., First National Bank Bldg., Oklahoma City, plans to improve and expand the capacity of its refinery. Work will be done by force account. Estimated cost $125,000.

Pa., Harmarville—Gulf Research & Development Co., Gulf Bldg., Pittsburgh, has awarded the contract for a 1 story, 35x53 ft. furnace oil test laboratory to G. Seaman, 6388 Pennsylvania Ave., Pittsburgh. Estimated cost $60,000.

Pa., Port Allegany—Pittsburgh Corning Corp., Port Allegany, has awarded the contract for an addition to its plant here to John W. Cowper Co., Buffalo, N. Y. Estimated cost $100,000.

S. C., North Charleston—Socony-Vacuum Oil Co., 26 Broadway, New York, N. Y., will construct a bulk storage plant for petroleum products. Work will be done by owner's forces. Estimated cost $50,000.

Tex., Seagraves—Columbian Carbon Co., 41 East 42nd St., New York, N. Y., has awarded the contract for the construction of a carbon black plant here to Fluor Co., Old Railway Exchange Bldg., Kansas City, Mo. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $1,500,000.

Tex., Odessa—United Carbon Co., Charleston, W. Va., has awarded the contract for the construction of carbon black plant here to Ford, Bacon & Davis, 39 Bway., New York, N. Y. Project will be financed by Defense Plant Corp., Wash., D. C. Estimated cost $5,000,000.

Wash., Everett—Weyerhauser Timber Co., Everett, will construct an addition to its bleach plant. Work will be done by day labor. Estimated cost $587,100.

Ont., Kitchener—Dominion Rubber Co., Ltd., 149 Strange St., Kitchener, has awarded the contract for a 3 story, 40x50 ft. addition to its plant to Dunker Construction Co., Ltd., 251 Kink St., W. Estimated cost $85,000.

Que., Gatineau—Canadian International Paper Co., Ltd., Sun Life Bldg., Montreal, Que., Can., plans alterations and improvements to its paper manufacturing plant here. Work will be done by owners. Estimated cost $85,000.

Que., Limoilou—Anglo Canadian Pulp & Paper Mills., Ltd., Limoilou, plans to alter and install new equipment in its plant. Work will be done by owners. Estimated cost $45,000.

Que., Montreal—Cheseborough Manufacturing Co., Ltd., 5520 Chabot St., has awarded the contract for the construction of a factory to W. G. Hunt & Co., Ltd., 1405 Bishop St. Estimated cost $122,000.

Que., Sherbrooke—Panther Rubber Manufacturing Co., Ltd., 29 Jencks Lane, has awarded the contract for the construction of a 2 story, 40x140 ft. addition to its plant to Stewart Construction Co., Ltd., 7 Dufferin Ave., Sherbrooke. Estimated cost $50,000.

Que., Ville La Salle—Builder's Products, Ltd., 240 St. Patrick St., has awarded the contract for the construction of an addition to its paper mill to L. Gordon Tarlton, Ltd., 912 McEachern Ave., Outremont, Que. Estimated cost $354,500.

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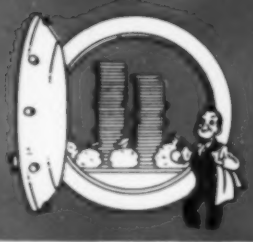

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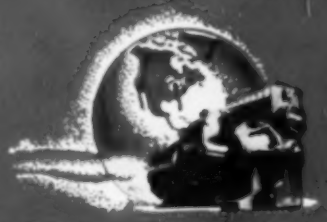
Their durability and stamina have been proven with millions of hours of service all over the world.



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More efficient than other types of slow speed drives . . . only 2% power loss in each stage of reduction in parallel shaft type.

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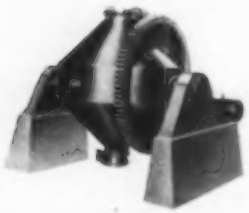

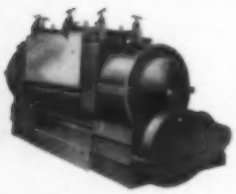

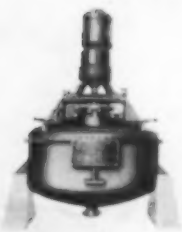

More efficient processing methods + dependable machinery = better products and better profits.

Richard L. Cameron
President

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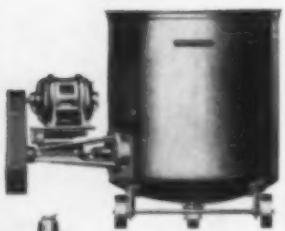

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